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Antimonytrioxide extraction from stibnum ore by hydrometallurgical method[†]

Kittisak Tiyapan

§ **The importance and origin of the problem**

Because Thailand has a large quantity of stibnum ores. But these are mostly of low grade, which makes it unsuitable to extract them by using heat (pyrometallurgy). The study of chemical methods of extraction will be beneficial because, apart from being economical, they better facilitate the control of the various variables involved. Also nowadays there is a continuous increase in the amount of Sb_2O_3 in industry. Preparation of Sb_2O_3 from stibnum metal has quite a high cost. Therefore there need to be a research towards methods of preparing Sb_2O_3 directly from from the stibnum ore which will help reduce greatly both the number of processing steps as well as the cost of production.

§ **Purpose**

The purpose of this experimental work is in order to find a suitable condition for the preparation of Antimonytrioxide directly from stibnum ores with the use of a hydrometallurgical process, by investigating the influence of those variables which affect the solubility, namely the temperature and time of leaching, the concentration of the leaching reagent used, and the concentration of the solution.

§ **Abstract**

Antimonytrioxide (Sb_2O_3) can be directly and efficiently prepared from antimony ores by the hydrometallurgical process one method of which is acid leaching. By studying the influence of the various variables which effect the efficiency of leaching, the sizes, and the shapes of of Sb_2O_3 crystals, it has been found that a suitable condition for the preparation of Antimonytrioxide from a stibnum ore which contains approximately 35.3% of Sb is by leaching it in the hydrochloric

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[†] Submitted to Department of Mining and Mineral Engineering, Chulalongkorn University, 1st March 1991

acid solution of ferric chloride at the temperature around 70–90°C requires approximately 1–1.5 hours by using $FeCl_3 \cdot 6H_2O$ approximately 10–20% in excess.

§ 1. Introduction

Antimonytrioxide (Sb_2O_3) is one of the major compounds of antimony. It is in the form of white crystals, has two types of structure, namely cubic (Senamonite) and rhombic (Valentinite), the molecular weight 291.5, the melting point 656°C, the boiling point 1,425°C, the specific gravity 5.2, and the hardness 2.0–2.5 Mohs scale. The solubility in water is 0.01 g/l at 100°C, slightly soluble in basic solution with increasing solubility as the basicity and the temperature of the solvent increase, highly soluble in the hydrochloric and the sulphuric acid, insoluble in the nitric acid, highly soluble in sulfide where the result is the thioantimonate solution, and extremely high solubility in the tartaric acid where it results in the antimony tartate solution.

§ Usage of antimony trioxide

1. Used as opacifier and emulsifier in enamel production. Being at the same time a good opacifier and a good emulsifier, Sb_2O_3 makes quality enamel that gives an enduring and glossy surface.

2. Used as pigment and lacquer. Sb_2O_3 makes good white pigment which has low rate of oil absorption (approximately 11–13 g / 100 g pigment), can withstand chemicals, light and heat.

Because Sb_2O_3 has a crystalline structure, it helps make strong pigment films. But paints which have Sb_2O_3 as pigment will dry slowly and soft, therefore it is often used together with ZnO in order to make pigments which dry quicker, stronger and have high adhesive strength.

Furthermore, Sb_2O_3 is a fireproof material that is waterproof, rustproof and insulate against heat, which makes it popular in making paints for ships, buildings and cables.

3. Used in glass and ceramic industries. Sb_2O_3 is used as decolouriser and clearifier in the manufacturing of glass. The green colour of FeO in glass normally affects its colour, glossiness and transparency . But if Sb_2O_3 is added while the glass is melted, it will sink down in the middle, and upon being heated will act as a decolouriser by reacting with FeO. Apart from this, at a very high temperature Sb_2O_3 will undergo a reduction reaction by releasing

O_2. At the same time, it can be volatile at high temperature. The release of O_2 and volatile gas by Sb_2O_3 helps eliminating air bubbles produced while the glass melts, and gives a more transparent glass, that is it acts as a clearifier.

4. Used as flame retardants in fibres and plastics. Flame retardants in general have the following properties.

    4.1 Reduce the combustion of fibres,

    4.2 prevent the spreading of flame,

    4.3 reduce the effect of heat on combustion,

    4.4 prevent smoke creation.

An ideal flame retardant when heated should produce a substance which can destroy the combustion mechanism. This function is called *synergesgic system*. For example, Sb_2O_3 in halogen polymer after heating fibres which are treated with Sb_2O_3 there will be chloride smoke produced which will reduce the air for the flame and finally extinguish it.
Sb_2O_3

in certain kinds of plastic not only helps reduce the ability to burn, but also help increase the resistance to heat, light and air.

Also, in the United States Sb_2O_3 has been widely used as flame retardants in wall papers and kitchen utensils. But in the case of flame retardant in carpets, hydrated aluminium oxide has more advantages because Sb_2O_3 when used in combination with some of the fillers in carpets will release toxic gases.

5. Other usages.

    5.1 Used in combination with antimony sulphide as filler in rubber industry,

    5.2 used as precipitant in manufacturing titanium white,

    5.3 added in petrol to reduce pollution, 5.4 used as catalysts in synthetic processes,

5.5 *etc.*

From the statistics of usage of antimony compounds in industry we find that antimony trioxide is the most useful, which is used mainly as flame retardant. We find that during the past 5 to 10 years the amount of Sb_2O_3 used as flame retardant in various kinds of material in Japan and the United States has rapidly increased, as can be seen in the table which forecast the amount of Sb_2O_3 compounds used in 2000 for the US.

Usage	**1984**	**1985**	**1986**	**1987**	**1988**
flame retardants	8,181	7,409	7,961	8,122	8,796
glass	311	298	183	199	294
paint/pigment	275	137	107	97	73
export (estimate)	21	24	24	32	75
others	410	279	212	126	130
total	9,198	8,147	8,687	8,576	9,368

Table 1 *Usage of* Sb_2O_3 *in Japan (tonnes).* **source:** *statistics of Nissho Iwai Co. Japan.*

Country	**1984**	**1985**	**1986**	**1987**	**1988**
S. Korea	–	–	10	69	44
China	1,076	1,103	1,950	2,194	4,066
Taiwan	–	36	36	51	139
Hong Kong	17	34	35	–	24
France	99	112	252	300	258
Belgium	2	–	18	24	54
Italy	–	–	–	–	–
U.K.	1,000	1,212	1,117	1,578	1,359
USSR	241	160	80	87	24
USA	2	15	91	35	108
Mexico	30	–	20	28	72
Bolivia	–	–	–	–	–
S. Africa	–	–	–	2	–
total	2,467	2,672	3,609	4,368	6,188

Table 2 *Antimony trioxide import in Japan (tonnes).* **source:** *statistics of Nissho Iwai Co. Japan.*

			2000 contingency forecasts for USA		
End use	1983	statistical projections	Forecast range		probable
			Low	High	
transportation	11,500	23,000	5,000	26,000	13,000
flame retardants	10,000	23,700	10,000	25,000	20,000
rubber products	1,000	3,900	500	1,500	1,000
chemicals	2,000	7,600	2,500	5,000	3,000
ceramics and glass	1,800	2,800	1,500	3,000	2,500
machinery	1,800	1,000	1,000	2,500	1,500
other	1,612	0	1,500	3,000	2,000
total	29,712	–	22,000	66,000	43,000

Table 3 *Predicted usage of antimony trioxide in 2000 of the United States (tonnes).* **source:** *statistical projections, provided by the branch of Economic Analysis are derived from regression analyses based on 24 year historical time series data and from forecasts of economic indicators such as GNP and FRB index. A statistical projection of zero indicated that demand will vanish at or before 2000, based on the historical relationship*

§ Standard for buying and selling of antimony trioxide

1. ASTM has set the standard for commercial grades of Sb_2O_3 as follows. Sb_2O_3 content, 99.2 – 99.5 %; Impurities (As, Fe, Pb, *etc*), ¡0.5 %

2. JIS has set the standard (JIS K 8407) for commercial grades of Sb_2O_3 as the following.

Sb_2O_3	Pb	Fe	Cl	SO_4
$\geq$ 98.0 %	$\leq$ 0.02 %	$\leq$ 0.01 %	$\leq$ 0.1 %	$\leq$ 0.01 %

3. Others. For Sb_2O_3 of other grades, the setting of standards depends on the usages, for example the standard set by Nihon Seiko Co.

   3.1 Type PATOX-U: Ultra fine particle antimony trioxide. Because this is used in specialised catalyst application which requires high surface activity, the standard is set as sizes of particle at 0.01–0.02 μ, which gives surface area as high as 50–100 m^2/g.

   3.2 Type PATOX-L:Course particle antimony trioxide. Because this is used in reactive applications, the standard set for the purity is the following.

Sb_2O_3	Pb	Fe	SO_4	H_2O
$\geq$99.3%	$\leq$0.03%	$\leq$0.003%	$\leq$0.005%	$\leq$0.1%

§ Antimony trioxide manufacturing technology

Antimony trioxide can be prepared from the antimony ore by using high temperature or by chemical leaching, which can be briefly described as the following.

1. By high temperature (pyrometallurgical process)

In this process we must first extract high concentration antimony metal, then pass it through the oxidation process to obtain the white residue of antimony trioxide, as shown in Figure 1. This process is rather complicated and the cost quite high.

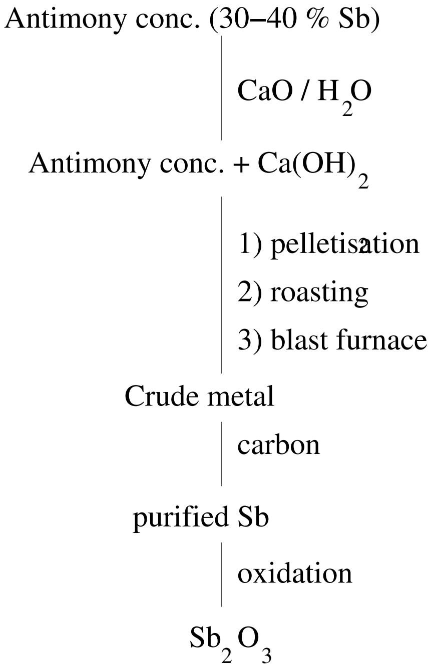


Figure 1 *Flow chart showing the process of manufacturing antimony trioxide by pyrometallurgy.*

2. By chemical leaching (hydrometallurgical process)

In this process we can directly prepare antimony trioxide from the ore. By using the principles of leaching and precipitation, we can easily eliminate impurities, which means a reduction in complexity and saving of energy. On top of that, we may also recycle the leaching agent.

The process of hydrometallurgy can be divided into two stages, namely

2.1 Alkali leaching. For example,

$$Sb_2S_3 + 3Na_2S \longrightarrow 2Na_3SbS_3$$

$$Na_3SbS_3 \xrightarrow{\text{electrolysis}} Sb$$

$$Sb \xrightarrow{\text{oxidation}} Sb_2O_3$$

2.2 Acid leaching. For example,

$$Sb_2S_3 + 6FeCl_3 \xrightarrow{HCl} 2SbCl_3 + 6FeCl_2 + 3S^0$$

$$4SbCl_3 + 5H_2O \longrightarrow Sb_4O_5Cl_2 + 10HCl$$

$$Sb_4O_5Cl_2 + NH_4OH \longrightarrow 2Sb_2O + 3 + NH_4Cl + HCl$$

Not only is the acid leaching more convenient than the alkali leaching, but we can also recycle the leaching agent ($FeCl_3$) for reuse by passing the solution $FeCl_2$ through air or oxygen gas, and the product $FeCl_3$ is easily obtained. Therefore this process merits a study in greater details.

The chemical extraction of ore not only is not complicated, requires lower cost and energy than extraction by heat, but can also reduce the problems of the effects on the environment that stem from the extraction by heat. Furthermore, this chemical extraction is also suitable to complex antimony ores with high impurities and difficult to extract by usual process, for example Jamesonite which is found in great quantity in the northern part of Thailand.

Because nowadays the demand of antimony trioxide in industry has greatly increased, it becomes more necessary to utilise complex- and low grade antimony ores. There is also the need to prevent the effects on the environment. Therefore chemical extraction of antimony, especially the process of acid leaching, is a technology of considerable importance both in the present and in the future.

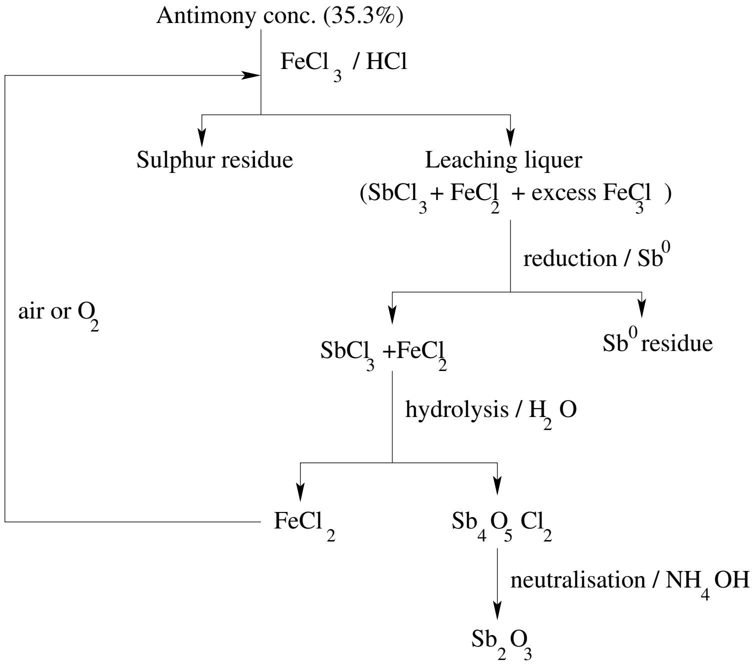


Figure 2 *Flow diagram showing the process of antimony trioxide extraction.*

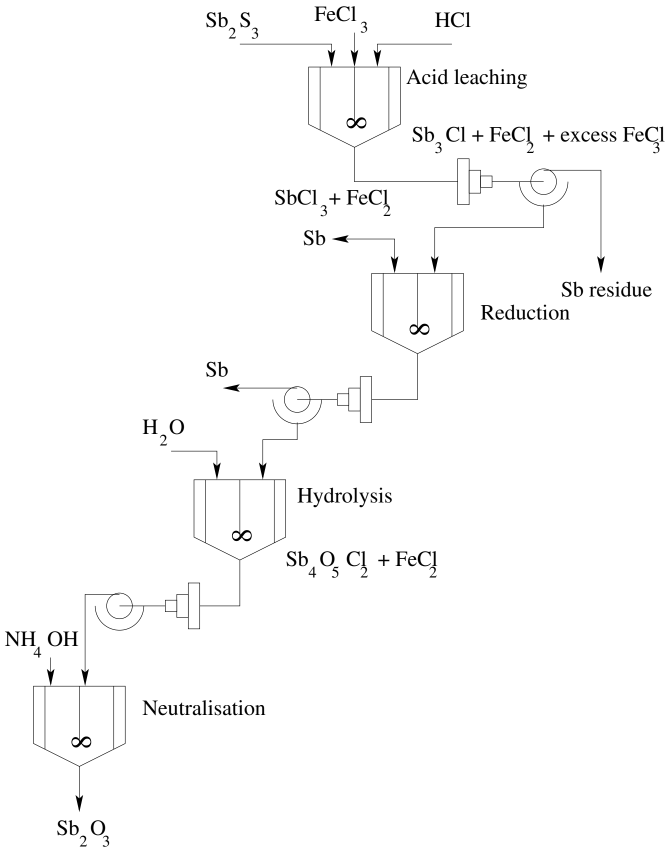


Figure 3 *Flow diagram modelling the* Sb_2O_3 *extraction in industry.*

§ 2. Experiments

§ Details of the experiments

1. Learn the methods and techniques of the processing of stibnum ore by the method of hydrometallurgy.

2. Analyse the composition of the stibnum ore sample that will be used in the analysis, in order to be able to find the suitable condition.

3. Find the suitable condition for the preparation of antimony trioxide that is in accordance with the industrial standards by studying the influence the variables have on the solubility efficiency, while maintaining high efficiency of production.

3.1 Study the effect of the temperature of solution

3.2 Study the effect of the time of solution

3.3 Study the effect of the concentration of the acid used in the solution

3.4 Study the effect of the concentration of the solution

§ **Experimental method**

1. Weigh 14.29 g of the finely crushed antimony ore (-100#).

2. Dissolve 38.93 g $FeCl_3 \cdot 6H_2O$ in 7N HCl and then heat by using heating mantel until the desired temperature is reached.

3. Slowly add the weighed ore into the solution and start timing.

4. Use pipette to extract the solution at 15, 30, 45, 60 and 120 minute to assay for the amount of Sb extracted at these times.

§ **Assaying for %Sb at each condition**

1. Use pipette to extract 2ml of the extracted solution at each condition, add 100ml distilled water in order for $SbCl_3$ to precipitate into $Sb_4O_5Cl_2$.

2. Filter the precipitate using number 42 filtering paper.

3. Dissolve the precipitate in concentrated HCl.

4. Add 1 g tartaric acid.

5. Drop a piece of red litmus into the solution, add 50ml water.

6. Slowly turn the solution into an alkaline solution by gradually

adding NaOH until the litmus paper turns from red into blue.

7. Slowly drop concentrated HCl until the solution changes back to become acidic.

8. Add 1 g $NaHCO_3$ to turn the solution alkaline.

9. Add starch solution as an indicator.

10. Titrate with 0.1 N iodine solution.

§ Method for Sb_2O_3 synthesis

1. Dissolve 14.29 g finely crushed ore into 7N HCl in which 38.93 g of $FeCl_3 \cdot 6H_2O$ has been dissolved.

2. Filter out the insoluble parts from the solution extraction.

3. Add finely crushed Sb metal into the solution thus filtered in order to turn all the excess $FeCl_3$ into $FeCl_2$ by stirring at room temperature for approximately 2 hours.

4. Filter out the insoluble parts.

5. Dilute the solution to 0.55N HCl concentration as a hydrolysis to precipitate $Sb_4O_5Cl_2$.

6. Adjust the pH of the $Sb_4O_5Cl_2$ precipitate to 7 by using NH_4OH solution at 70°C as the neutralisation. The result is the Sb_2O_3 desired.

7. Filter and then bake dry.

§ 3. Experimental results

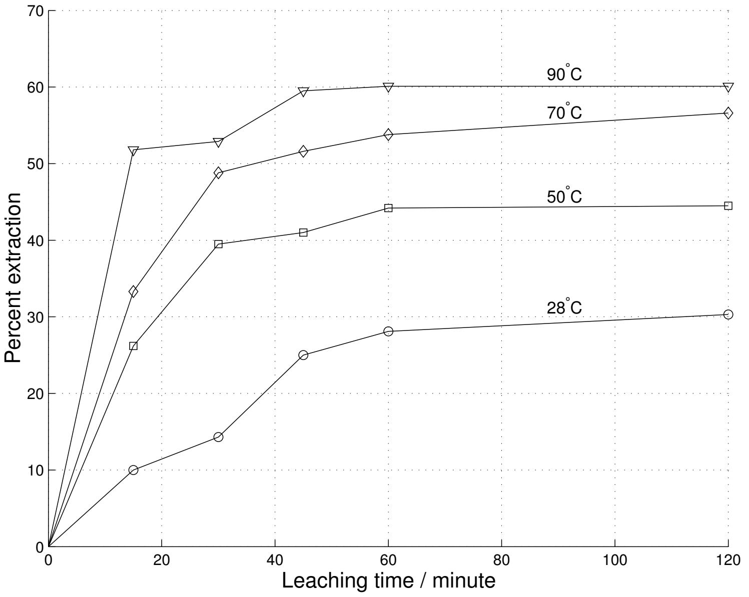
§ 3.1 Influence of the leaching temperature and time

3.1.1 Efficiency of the extraction when leaching the ore in 7N HCl 100 ml.

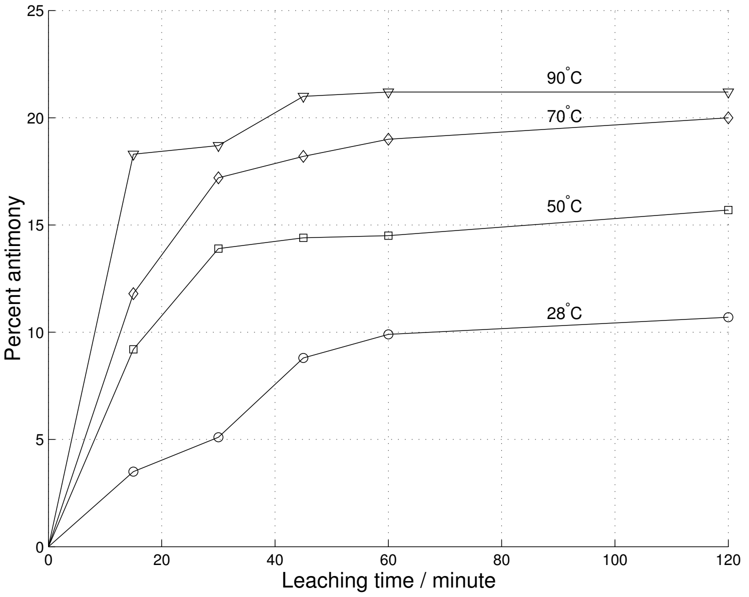
Time	Extraction temperature							
(minute)	28°C		50°C		70°C		90°C	
	% Sb	% Extr.	% Sb	% Extr.	% Sb	% Extr.	% Sb	% Extr.
15	3.5	10.0	9.2	26.2	11.8	33.3	18.3	51.8
30	5.1	14.3	13.9	39.5	17.2	48.8	18.7	52.9
45	8.8	25.0	14.4	41.0	18.2	51.6	21.0	59.5
60	9.9	28.1	14.5	44.2	19.0	53.8	21.2	60.1
120	10.7	30.3	15.7	44.5	20.0	56.6	21.2	60.1

Table 4 *Experiment results at various time and temperature of extraction.*

From Table 4 and Figure 4 we find that the efficiency and the rate of extraction increase when the extraction temperature increases from 28°Cto 50, 70, and 90°Crespectively. Both the efficiency and the rate of extraction become constant at temperature higher than 70°C. This means that the optimal extraction temperature must be within the range of 70–90°C.



(a)



(b)

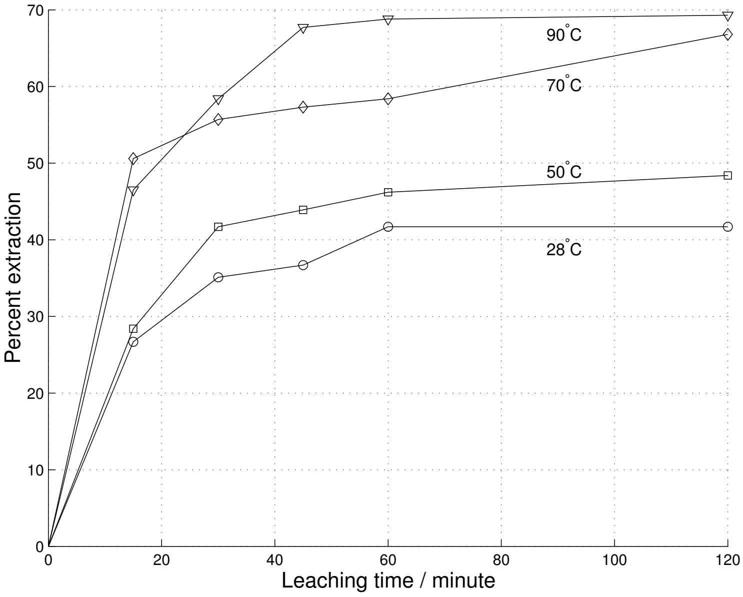
Figure 4 *Percent extraction (a), and antimony (b), when the leaching solution contains 100 ml 7N HCl and 38.93 g* $\mathrm{FeCl_3 \cdot 6H_2O}$.

3.1.2 Efficiency of the extraction when leaching the ore in 7N HCl 300 ml.

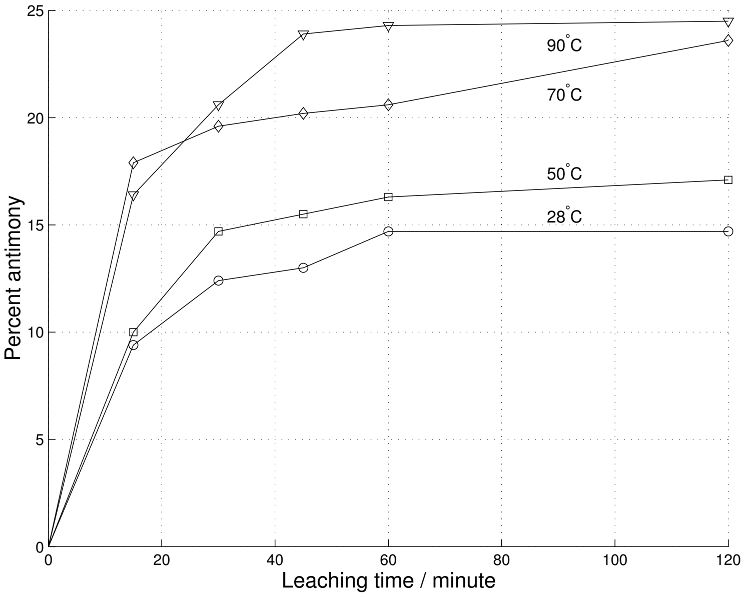
Time	Extraction temperature							
(minute)	28°C		50°C		70°C		90°C	
	% Sb	% Extr.	% Sb	% Extr.	% Sb	% Extr.	% Sb	% Extr.
15	9.4	26.7	10.0	28.4	17.9	50.6	16.4	46.5
30	12.4	35.1	14.7	41.7	19.6	55.7	20.6	58.4
45	13.0	36.7	15.5	43.9	20.2	57.3	23.9	67.7
60	14.7	41.7	16.3	46.2	20.6	58.4	24.3	68.8
120	14.7	41.7	17.1	48.4	23.6	66.8	24.5	69.3

Table 5 *Experiment results at various time and temperature of extraction.*

From Table 5 and Figure 5 it can be seen that the efficiency and the rate of extraction increase as the extraction temperature increases from 28°Cto 50, 70, [and] 90°Crespectively in a manner similar to the case where the ore is leached in 7N HCl 100 ml. But both the efficiency and the rate of extraction is higher than the previous case by approximately 10 percent. This means that the amount of acid used in the extraction by acid leaching has some influence on the efficiency and the rate of extraction.



(a)



(b)

Figure 5 *Percent extraction (a), and antimony (b), when the leaching solution contains 300 ml 7N HCl and 38.93 g* $FeCl_3 \cdot 6H_2O$*.*

§ **Influence of the leach solution concentration**

The controlled variables are $FeCl_3 \cdot 6H_2O$ 38.93 g, the concentration of HCl 7N, and the ground antimony ore 14.29 g.

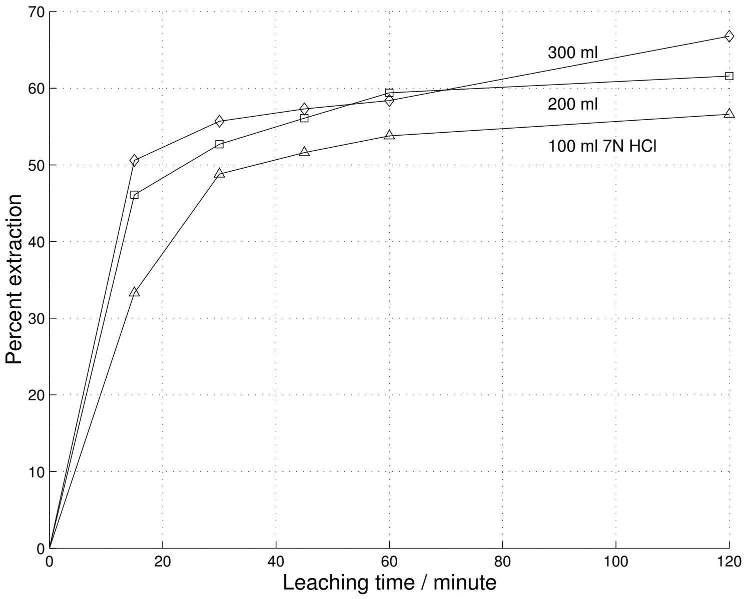
From the data in Table 4 and Table 5 we can draw Figure 6 (28°C), 7 (50°C), 8 (70°C), and 9 (90°C). [Figure 5 to 9, omitted here, compare between 7N HCl 100 and 300 ml] It can be seen that when the amount of acid used is increased from 100 to 300 ml at the extraction temperatures of either 28, 50, 70, or 90°C, the efficiency and the time of extraction invariably increase by approximately 10 percent.

When further experiments are done at the temperature of 70°C, which is a suitable temperature for the extraction in practice, the results obtained are the following. The controlled variables are 7N HCl 200 ml, $FeCl_3 \cdot 6H_2O$ 38.93 g, and the extraction temperature 70°C.

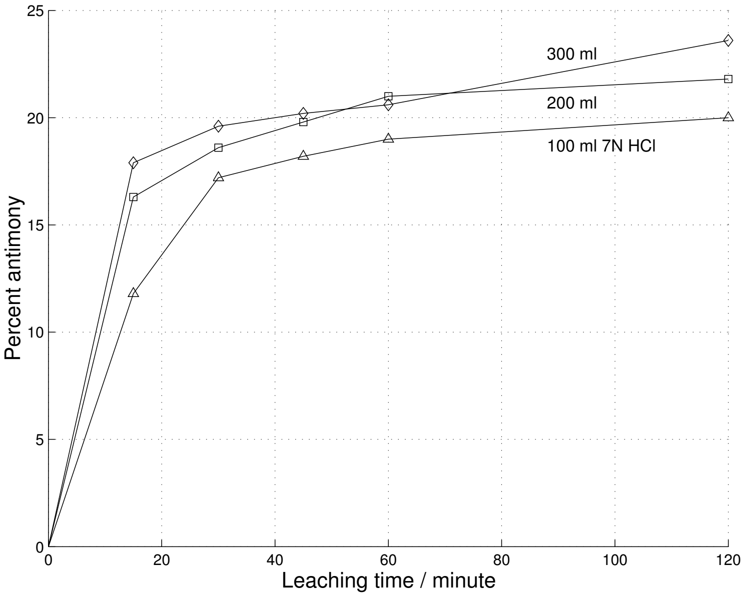
Time (minute)	15	30	45	60	120
% Sb	16.3	18.6	19.8	21.0	21.8
% Extraction	46.1	52.7	56.1	59.4	61.6

Table 6 *Experimental results at 70°C, 200 ml 7N HCl.*

From Figure 10 one finds that the efficiency and the rate of extraction at 70°Cand the acid concentration 7N increase by approximately 5 percent when the acid amount increases from 100 ml to 300 ml. This means that the efficiency increases as more acid is used.



(a)



(b)

Figure ℵ *The effect of various amount of HCl on the extraction efficiency. Percent extraction (a), and percent of antimony (b) in the solution which contains 7N HCl 100, 200, and 300 ml, and 38.93 g* $FeCl_3 \cdot 6H_2O$*, at 70°C.*

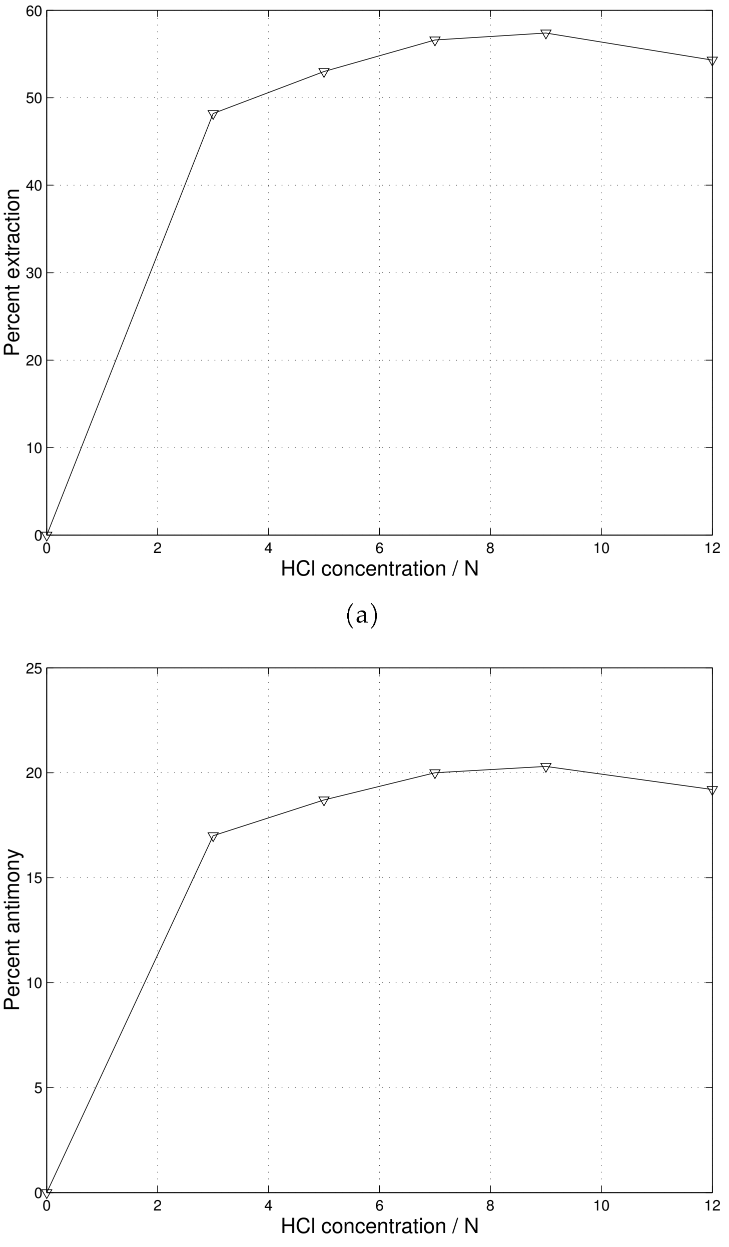
§ 3.3 Influence of the acid concentration used in leaching

The controlled variables are $FeCl_3 \cdot 6H_2O$ 38.93 g, HCl 100 ml, the extraction temperature 70°C, and the time of extraction 2 hours. Vary the concentration of HCl to be 3, 5, 7, 9, and 12N.

Concentration (N)	3	5	7	9	12
% Sb	17.0	18.7	20.0	20.3	19.2
% Extraction	48.2	53.0	56.6	57.4	54.3

Table 7 *Experimental results at various acid concentrations.*

From Table 7 and Figure 11, the efficiency of extraction is highest between the acid concentration 7 and 9N, that is the suitable concentration in practice is 7N.



(a)

(b)

Figure 11 *Effect of the acid concentration on the leaching efficiency, (a) the percent extraction, and (b) the percent antimony. The leach solution contains 100 ml HCl and 38.93 g* $\mathrm{FeCl_3 \cdot 6H_2O}$at70°C.

When precipitating Sb_2O_3 at the room temperature and at the temperature 90°C, and then take the SEM pictures of the precipitates, the results are shown in Figure 12 and 13 [omitted]. From these it can be seen that when precipitating at a low temperature, the structure of Sb_2O_3 tends to be more cubic than when precipitating at a higher temperature. Therefore if Sb_2O_3 of a cubic structure is desired, the precipitation should be done at a low temperature, while on the other hand if Sb_2O_3 of a rhombic structure is desired, it should be done at a high temperature.

§ 4. Conclusion and suggestions

From the experiments studying the influence of variables in the preparation of Antimonytrioxide from stibnum ores by hydrometallurgical method with the leaching of the ore in an acid solution of ferric chloride it was found that the production of Sb_2O_3 by hydrometallurgical process on the industrial scale has a reasonably high viability when leaching the mineral solution in the hydrochloric acid solution of ferric chloride the acidic concentration of which is between 5–9N HCl at the temperature range of 70–90°C for approximately 1–1.5 hours and with $FeCl_3$ about 10–20% in excess.

§ Acknowledgements

This research has been possible because of the support from many people. I thank Assistant Professor Dr. Khvañjaï Liphǎobanḋhu, Assistant Professor Dr. Prabanḋh Gụsȧkul, and Lecturer Dr. D́ạvalẏ Vivadhranȧd́ẹj for having given the support and advice throughout the project. I thank the Mining Engineering and the Mining Geology Departments, Chulalongkorn University, and all the staffs in the chemical laboratory of the [former] department for having given assistance, advice, and the working space used in the course of this research.

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Cyberspace

Kittisak Tiyapan[†]

Cyberspace is an interesting word that originated from a science-fiction novel by William Gibson. It was adopted by John P. Barlow for the first time to describe the nexus between computers and communication network.

Cyberspace has found its place in our everyday lives and has increased rapidly both in magnitude and in importance. Generally speaking, it conveys the idea of a kind of world created by interconnection between computer systems and telecommunication network. We may think of it as another dimension apart, if not totally separated, from this earth that we live in. It is a kind of virtual reality in its own right.

In this new environment created by communication systems, to mention just a few of which are Internet and CommerceNet, there are features and structures (or virtual structures) that make it a unique world in its own right. It is populated by people (more than 20 million on Internet alone, growing at a rate not less than one million new users per month), it has got addresses, societies, even libraries and educational institutions.

There are businesses going on around the clock sending back and forth not only correspondences but also quotations, invoices and other documents both important and confidential. There are bad guys trying every possible way to do nasty things, and there are also good guys outwitting themselves just trying to catch those that have done bad things or merely just to prevent them from doing so. There are thieves, polices, security officers, etc., as there exist in the real world.

No matter how we view it, this is another dimension. It is not real, in the sense that we use in our four-dimension world, but it is alive. It was created, it is growing fast, it may need a lot of effort for organisation (and I assure you that this is by far an easy task), but it is here to stay.

[†] This article was written when Kit was an M.Sc. student in Control and Information Technology at University of Manchester Institute of Science and Technology, England.

§ Recommended book

Bruce Sterling. *The Hacker Crackdown. Law and Disorder on the Electronic Frontier.* Penguin Books, 1992.

§ Interesting terms

Cyberspace The notional environment within which electronic communication occurs, especially when represented as the inside of a computer system; space perceived as such by an observer but generated by a computer system and having real existence; the space of virtual reality. (cyberpunk + space) (Shorter Oxford Dictionary, 1993)

Cyberpunk A genre of science fiction that features rebellious computer hackers and is set in a dystopian society integrated by computer networks. (cyber(netics) + punk) (Collins English Dictionary, 3rd ed., 1991)

Cybernetics The branch of science concerned with control systems in electronic and mechanical devices and the extent to which useful comparisons can be made between man-made and biological systems. (comes from a Greek word which means *steersman*) (Collins English Dictionary, 3rd ed., 1991)

Cyberphobia Irrational fear of computer.

Cyborg An integrated man-machine systems. (cybernetics + organism)

An introduction to Angus Macvicar

Kit Tyabandha, Ph.D.

9th July 2004

A Scottish writer, Angus Macvicar (1908–2001) studied at the Glasgow University and went to the war with the Royal Highland Fusilier. I came across his writing at the Newton Heath Public Library in Manchester, I think in 2002. The book I read was his *A Highlands omnibus* (1991), which contains three of his previously published works, namely *Rock in My Scotch* (1977), *Silver in My Sporran* (1979) and *Bees in My Bonnet* (1982).

In *Silver in My Sporran* he talks about himself and his life. He attended during 1920–6 the Campbel Town Grammar School. He mentions his stammer. With Professor McNeile Dixon he studied English at the University at Gilmorehill. Here he read Beowolf, Burns, Chaucer, Dickens, Dunbar, Georg-Eliot, Henryson, Keats, Milton, Scott and Shakespeare. He talks about *Kubla Khan*, Bunyan's *The Pilgrim's Progress*, *Pecheur d'Island*, and D K Broster's *The Flight of the Heron*. He talks about his writing career, Buchan's *John McNab*, Michael Joseph's *Short Story Writing for Profit*, B.S. 1219, that is the 1918 recommendation which gives table of galley proofs by the British Standards Institute of Symbols.

About Alec MacLeod, he says, 'Like George Blake and Neil Munro, he was an advocate of simplicity. "It's easy to use flowery language," he often told me, echoing Sandy Banks my old English master. "Not so easy to be straight forward!"' He also said, 'that above all else a writer must have integrity, both moral and artistic.' After that, 'I'd respect you far more if you displeased me with something I knew came from your heart. And so would any editor worth his salt. Insincerity always shows and lowers the reputation not only of the paper but also of its readers.' 'For me, competition for its own sake is enjoyable. Prizes, in a material sense, are irrelevant.' He mentions about Anthony Blond's *The Publishing Game*.

As a teenager he 'was intrigued' that Agatha Christie 'had gone missing' by what was concerned with temporary loss of memory, which proved to be a duodenal ulcer. Len Deighton's *Only when I Larf* failed while *English in Libya* passed. So does Mario Puzo's *The God father*, whereas Charles Darwin's book on passerine birds, translated in1879 as *An Informal History* sold seven copies in the first year, one in the second, and thirteen during the following 23 years.

'All my writing life I have aimed at producing a best-seller', he said, 'But it is something, I now believe, that a genuinely dedicated author should never do, and it may explain my comparative lack of credibility as an "important" one.'

He mentioned Bob Cowan. He talks about his first book *The Purple Rock*, which was an adult thriller, his first stage play *Murder in Letter more*, the echoes of which Robert Louis Stevenson heard, or so he tells us, 'and from the bare bones of fact produced *Kidnapped* and *Catriona*.' The story concerns the murder in 1752 of Colin Campbell of Glenure and the subsequent trial of James Stewart of the Glen (*Seumas a Ghlinne*.) Some extractions from the story are given below.

> Yes, sir, it has lasted long. And if this is your attitude to a man's struggle for his life, then the memory of a great injustice will last even longer!

The 35th Psalm is known in the West Highlands as 'James of the Glen's Psalm.' The following are words of James Stewart.

> I am not afraid to die, but what grieves me is my character, that after ages should think me capable of such a barbarous crime. I declare my complete innocence. Nevertheless, I bear no grudge against the jury and the witnesses; and may this my hard fate put an end to all discords among you. May Stewart and Campbell be united in brotherly love and charity; and may God grant us all a joyful meeting at the Great Day of Judgement.

In 1752 Colin Campbell of Glenure was murdered. Allan Breck Stewart fleed to France. James Stewart of the Glen (*Seumas a Ghlinne*) was hanged. Macvicar heard about this story first from his mother, a native of Appin, only a few miles from Duror where the murder took place. James Stewart occupied the farm of Acharn in Duror. James became the leader of his clan after Ardshiel, his half-brother, was exiled.

Breck is a Gaelic word that means pockmarked. Allan Stewart was hard-drinking and wild. Colin Campbell had auburn-hair, and was nicknamed 'the Red Fox.'

On 14th May, at Glenure, his servant John Mackenzie, a lawer from Edinburgh Mungo Campbel, and a sheriff Donald Kennedy set out from

Fort William to carry out the eviction, which was that of a murder. We learn from Angus that in many cases 'Leave it with me!' generally means 'Forget about it!' James Stewart said to John in Gaelic, 'Ah, John, whoever is the culprit I shall be the victim.' And who shot *the Red Fox*? After all, Macvicar thinks that the real murderer was probably Donald Stewart of Ballachulish.

We have seen how Macvicar mentioned Stevenson's using the murder story he told in some of his novels. On the internet I once came across a writing which claims one of Macvicar's poem published in 1982 taking after, that is to say, imitates a poem that was in 1974 published in the US. The poem in question is *Would you believe it?* It was included in *Bees in my Bonnet* (1982).

Beechwood fires are bright and clean
If logs are kept a year.

Chestnut's only good they say
If for long it's stowed away.

Birch and fir logs burn too fast
Blaze up bright and do not last.

It is by the Irish said
Hawthorn bakes the sweetest bread.

Elmwood burns like churchyard mould
E'en the very flames are cold!

Poplar gives a bitter smoke
Fills your eyes and makes you choke.

Apple wood will scent your room
With an incense-like perfume.

Oak and maple, dry and old
Keep away the winter cold.

But ash wood wet and ash wood dry
A king shall warm his slippers by!

The other poem is so similar to this on of his, that for all purposes and intentions there could be neither coincidences nor questions. Because, as it was said, Macvicar had obviously not revealed that as the source, one possibility could be that he had heard that poem repeated to him by somebody without having seen it in the original, printed form.

Kit Tyabandha
Manchester, UK

Roman System of Writing for the American Sign Language based on Stokoe's System

K. N. Tiyapan †

3rd October 2002

Abstract

A new Roman writing system is developed here for ASL as a part of the project to develop writing systems for all languages based on the Roman alphabet. The idea is in order to increase the connectivity among languages.

Introduction

The American Sign Language (ASL) plays an important role in setting the international standard of Signs, and acts as a basis for systems of sign languages in other countries. For instance, most of the words in Japanese Signs are the same as those in ASL.

Development of the present system

The present system is but a part of a wider research project of developing systems based on the Roman alphabet. The main part of this project, which is a part apart from what is presented here, concerns Sanskrit-Pinyin-Tiyapan systems, which as the name suggests are grounded in the romanisation of Sanskrit and the tone symbols of Pinyin.

The roman writing of ASL

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Tab

(*nte*)	zero; neutral
fca	face, whole head
fhe	forehead, brow, upper face
mvi	mid-face, eyes and nose
cni	chin, lower face
cke	cheek, temple, ear, side-face
nke	neck
tra	trunk, body from shoulders to hips
mra	upper arm
mya	elbow, forearm
spa	supinate arm or wrist
pro	pronate arm or wrist

Dez

t	*a* compact hand
ts	fist, *s* compact hand
tz	*t* compact hand
b	flat hand
bs	flat hand with four fingers separated
s	spread hand
c	curved hand
d	contracted hand
f	*three-ring* hand
g	*g* index hand
gd	*d* index hand
h	index and second finger extended; *h*
huw, hun	the *u* allocher of *h*
how, hon	the *n* allocher of *h*
j	*pinkie* hand
k	like *g* but thumb touches the middle phalanx of the 2nd finger
kow, kon	the *p* allocher of *k*
l	angle hand; thumb perpendicular with the index finger
z	*cock* finger; thub and the first two fingers spread
p	tapered hand; fingers curved and squeezed together; *o*
r	*warding off* hand; the 2nd finger crosses over the index
v	*victory* hand
w	three-finger hand
x	hook hand; index hooked
y	horns hand (thumb and little finger)
ys	horns hand (index and little finger)
q	the little finger bent in from a spread hand

Sig

u	**u**pward
o	d**o**wnward
uo	**u**p-d**o**wn
i	r**i**ghtward
e	l**e**ftward
ie	s**i**de-to-sid**e**
a	tow**a**rd signer
ao	**a**way fr**o**m signer
oa	t**o**-**a**nd-fro
ui	s**upi**nate rotation
iu	pronate rotation
ou	twisting
ue	nodding, bending
oe	**o**p**e**ning
ae	closing
eu	wriggling of fingers
ia	c**i**rcular **a**ction
~ach	convergent action; appro**ach**
~act	cont**act**ual action, touch
~asp	linking, gr**asp**
~oss	cr**oss**ing action
~ent	entering action
~ide	divergent action, separate
~int	**int**erchanging action

Other auxiliary symbols

ei	side-by-side hands
ai	one hand held behind the other
~t	repeat the whole Sig
~ts	two or more repetitions
~l	with finger bent, *i.e.* c**l**awed
~ate	altern**ate**ly by one hand and then the other
~us	new Dez th**us** transformed
~nd	compou**nd**ing
~n~	a**n**d
~d~	*Ger. dann*; then

Table 1 *Roman writing of Stokoe's system for American Signs*

Reference

William C. Stokoe Jr., Dorothy C. Casterline and Carl G. Croneberg. *A Dictionary of American Sign Language on Linguistic Principles.* Gallaudet College Press. 1965

Bus-pass, a freedom

Kit Tyabandha, Ph.D.

1^{st} May 2004

Bus provides a service. This service is not to get you from one point to another, because there are limits with regard to both the routes of bus and the locations of its stops. Rather, one may say, the service is freedom. One no longer has to drive and cope with all the activities that come with driving, for example finding a parking space and observing road codes.

The most important benefit of bus over other means of transportation is not that it is cheaper, but that it can act not only as a mean but also as a medium. In the theory of percolation in Physics liquid flows through porous media; in traffic systems vehicles flows along a road network. While every vehicle is a mean that gets you somewhere, only the bus may be made into a medium. What makes this difference between the two is the latter adoption of term-, in Japanese *nori houdai*, tickets. These are tickets which allow one unlimited travel on a group of vehicles within a certain period. The freedom they give does not come with the unlimited number of rides, because that is in fact limited by the finite time we have in our life, and when one ride a bus for one hour he has also to keep the ticket with him all the time, so that it may not be used again to make another journey before he gets off the bus. The freedom is in being able to move from one vehicle to another freely as one choose. When this happen, we effectively move through the buses, which in turn flow through the roads. The degree-of-freedom of both the bus and the road is spatially restricted, but with the power of choice we have we are less so. You may get off your bus, for example, in the middle of a traffic jam, then walk along the road, and then either get on another bus or do something else in the meantime. You man also change your route, and choose some other ways where you think the streets are less likely congested. In other words we now have people flowing through a network of buses, which flow through a network of roads.

The idea of percolation (see, for instance, Dietrich Stauffer and Amnon Aharony's *Introduction to percolation theory, 1985*) is that we may represent any change of phase of something by viewing its internal structure as a network where the dominance of the two phases in question changes hand. Related to the study of percolation is the observation made on clusters of one or both of these phases. In traffic systems the phases are normally called blocked and unblocked. Unless the criterion of dominance is exactly 50 per cent we have not two but three conditions possible, that is free-flowing, congested and stand-still. Travelling by car one is at all time identified with the car one is driving. Similarly each bus can be considered as a cluster of size one, and all the people riding therein to be identified with it. However, through the use of term-tickets, one is no longer bound to a single bus but may freely move from one to another. All the buses covered by such a ticket form a single cluster. A rider equipped with the ticket can now wend his way through the different buses that belong to the cluster. And though the rate of flow of people is no more than a walking pace between any two buses, through human imagination and planning the degree-of-freedom would be greatly raised.

Coupons have another use vastly different from this, they form no clusters in this sense. Theirs is a kind of money, a local currency similar to the Roma invented by Gerry Mc Garry to be used by volunteer organisations in Ballyhaunis, Ireland, in 1999 (*cf* Richard Douthwaite's *The ecology of money*, 1999). Money serving basically two functions, namely as the store-of-value and as the medium-of-exchange, its various types may serve as a semi-permeable membrane around certain sector of the economics, or certain region of the nation. If used wisely, these membranes can balance the in- and out-flows, engender local investment, and give protection from external influences. However, in order to have these benefits it may be necessary to make the denomination and unit of the coupon and the national currency different. Whether this is good or not as regarding the robustness of the nation as a whole is still unclear. The current idea, which shows itself in the cases of the dollars in case of the United States and the euros in case of the European Union, is that a single currency binds a cluster together. Having said that, the use of a specific-purpose currency like coupons does offer an obvious advantage in the possibility to change both the service offered and the rate of exchange in the form of discounts.

Many things that matter are neither obvious nor easy to see. This is mostly true in all the cases of transition in percolation, where the linear gathering of momentum is hidden, and only the abrupt transition which occurs as a result is observed. An example of this is the prosperity of a country which is shown by economic indicators, but which is grounded in things like the basic education and a sound infrastructure. A bus management who aim not only making for their company a short-term profit but also at helping with easing the traffic problems and making the life in the city easier, in the end will prove to be the most beneficent to the company they profess to love. Not only by doing so can they increase the popularity of their company, but also they can draw its competitors into it, and thereby making business partners and a team. Thus the term bus-ticket could be a precursor to bus-passes of various companies, and then to a single-pass that covers both the buses of the different firms, as well as the sky- and underground trains. Not to mention, so it seems, the boats in the canals and rivers, and all the canals to be restored in the future.

Kit Tyabandha
Bangkok, 2004

Creation and Percolation

Kit Tyabandha, Ph.D.

11^{th} July 2004

Let us define God as Superset, the largest superset of all. Then that God exists is evident because, since we exist, so does God. In fact if anything exist, so does He. Even if nothing ever existed, still He would.

The Big Bang was a change of phase. The Singularity at the transition is both nothingness and an infinite barrier dividing the Universe from the other side. We know what is is like on this side of it through our physics. It is not possible to apply the same further back beyond Planck's time.

When Charles Darwin discovered the evolution process he discovered that evolution is part of Creation. This means that the latter is not an instance but a process. This process of Creation, Evolution and Percolation goes on forever, but we only see it through the events of transition produced from time to time. To the knowing these frequent occasions are inevitable but unimportant in itself. It is the process behind it that is everything to them.

In this light percolation goes back as far as the Big Bang. And when we watch the pot boiling in the morning, or chance upon a frozen lake in winter, we may keep in our mind that they are both percolation within Percolation.

Death, for example, is a transition and percolation. The immediate process that leads to it is that of aging. Birth, on the other hand, although also a transition, has its process in Evolution itself.

In fact the more one study the more one find percolation is everything. Creativity, invention and understanding are all percolation. Enlightenment, which is a certain degree of understanding, is also a percolation.

From our experience we know that there are two types of percolation, one network and the other continuum. All created entities seem to fit in well as being part of the network which percolates. Not necessarily nonentity, but intangible things like ideas and understanding seem to fit in better with the continuum case. Yet all this may be only various views of the same thing. It could be that continuum at the same time is network, and for that matter network continuum.

When colloid block a network, it percolate first the space within the voids, and after that the porous media. The interrelationship of things with their surrounding makes it difficult to find out about everything that goes on in this case. And the smaller our particles, the closer they become to the effects of Quantum Mechanics, how can we simulate them on the computer? We may be satisfied with our results from numerical studies of thought-up situations, but how can we cope stochastically with a continuum percolation in real life?

Man is neither everything nor are we invariably intelligent. We have come closer now to solving the puzzle of Genome without ourselves being that particularly sophisticated. At best what used to be thought of as being continuum is looking more and more a network. But even though a network it is still too large. How can one simulate a percolation on it on the computer? Even with a network percolation of a network of this size seems impossible with the present technology, granting projection ahead in time with an optimistic mind. Do we need another revolution before we can study evolution?

Kit Tyabandha
St Gabriel's, Manchester UK

The End of Stars

Kittisak Tiyapan †

February 1995

> Star light, Star bright,
> I wish I may, I wish I might
> Have a wish I wish tonight.
> I wish I . . .

This is only one of our many childhood fantasies. After we have grown up, though some of us still say this at night once in a while, our imagination may lead us to wonder further into that infinite depth of the universe.

There have been many theories about how stars are formed and about the evolution of stars. One theory which is widely accepted is that in the beginning there was nothing but a point called *Singularity*. After that a huge outburst of mass and energy or *Big-Bang* occurred. The universe expanded.

After expanding for quite a while, galaxies and stars were formed as a result of non-uniformity in the density of gases. These gases came together because of gravity, got more massive and thus attract more gases. Molecules came close to one another until a point was reached when a fusion process started. The fusion process of a typical star starts from Hydrogen being fused to become Helium. When there is enough Helium in the core, Helium atoms are fused and Carbon atoms formed. The similar processes occur with Carbon, Oxygen, Neon, Magnesium, Silicon and Iron respectively. Iron-fusion does not produce energy so it never occurs. At this stage the star is said to have passed its prime. It produces less and less energy. Temperature reduces. Outer-surface that has previously been bloated out far-and-beyond by the nuclear fusion withdraws itself because of the star's gravity.

There are many ways for a star to end its life. If a star is small, then it dies. But if it is huge to start with, its faith is much more tragic. For example, a star with mass 100-times that of the sun will contract gradually until a critical point is reached. At this point the outer surface of the core bounces back a little while its neighbour outer layers keep moving inward. There is a shock-wave. An explosion occurs where outer-layer which comprises mainly of gases is expelled outward. This is a Super-nova. After this the remaining core contract so rapidly that it never stop. At last it becomes only a mere point in space without any dimension called *Singularity*. A black hole is formed.

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† The author wrote this article while he was at University of Manchester Institute of Science and Technology.

Although there are controversies about what implications resulted from the existence of black-holes, scientists believe that they exists. Some claims that black-hole is an inherent time-machine. Some says there exist worm-holes connecting two black-holes located at different corners of the universe acting much like a short cut across space.

Nature is much greater than human beings. We are only a speck of dust in this universe. What will be in your mind when you look up at the stars tonight to make your wish ?

§ Recommended books

Stuart L. Shapiro and Saul A. Teukolsky. *Black holes, white dwarfs, and Neutron stars – The physics of compacts objects.*

Joseph Silk. *The Big Bang.*

§ The evolutionary process of stars

- Hydrogen is burnt and Helium is formed
- Helium forms the core because it is heavier
- Star expands as a result of the fusion process
- Amount of Hydrogen lessen
- Inner-core contracts. Temperature and pressure increase
- Fusion of Helium starts
- Carbon resulted from Helium fusion forms inner core
- Fusion of heavier atoms: O, Ne, Mg, Si, Fe respectively
- Iron does not fuse

– Stars with: mass < four-times that of our sun, become white-dwarfs. (Nova) Mass between four- and eight-times of the sun, blow itself up completely, core and all; mass between eight-and fifty-times of the sun, blow outer part, core forms neutron star. (Super-nova) Mass > fifty-times that of the sun, blow outer part, core becomes black-hole.

§ **Differences between stars and planets**

- Stars shrink in size when its temperature is reduced, planets do not.

- There is fusion process in stars but not in planets.

§ **Terms**

White-dwarf Dead star with very density. Sustained by atom-decomposition force.

Neutron-star Dead star which comprise of pure neutron. Sustained by neutron-decomposition force.

Pulsar Strong periodic source of magnetic-field. Produced by a Neutron-star.

Quasar Strong X-ray source. Produced by a Black-hole.

Vol. 1, No. 1 Tyabandha Journal of Arts and Science

Modelling the Economics

Kittisak Tiyapan †

October 1997

§ Abstract

Abrupt or rapid changes happened often through out the history of economics. Despise the fact that they are very important they are still not well understood. Attempts to simplify them down to mathematical equations have proved to be difficult. This paper suggests that simulation on a random networks model should be a more appropriate approach.

§ Introduction

Early study in economics deals with only one or few things at a time. For example one studies about population, ratio of land to population or the trend in GNP of a nation. This proved to be both ineffective as well as misleading. Later studies in economics emphasise more and more on the interrelation among several factors (Forrester, 1971). In this approach the economics is studied as being a complex multivariable systems. Though the analysis from such approach is much more satisfactory it is still not possible to predict the future of the economics of a nation. There are even situations which can not be explained. An example of these is hyperinflation. Among the most baffling occurrences of hyperinflation in history are that which happened to Hungary after both world wars and that which happened to China after the second world war. A more recent example of hyperinflation is that which occurred in eastern European countries for example, the inflation in Poland which rose above 600 percents in 1989 (Fisher *et al*, 1996). While such abrupt transitions in economics have been puzzling economists for centuries, physicists have been more accustomed to them. Scientists in the field of physics and chemistry have more than one way to explain a phase-transition. Such a phase transition is not a result of any single decision of the government but, rather it is a result of various accumulated potentials. Among the existing theorems which use a similar idea of effect of gathering potentials is the *cobweb* theorem (Davis, 1980). A model which can explain the phase-transition situations in economics will greatly increase our understanding in economics. In this work it has been suggested that a tool which has proved itself to be useful in physics can also be applied to the study of economics.

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† The author wrote this article while he was at Tokyo Institute of Technology.

§ **Theory**

Economics is a complex systems. It is a system because it is governed by certain rules. It is complex because there are so many factors involved and the rules are complicated. Systems which has got such complicated nature and covers a great many individual components can be best represented as a geometrical networks of components and interactions among them.

Figure 1 and Figure 2 shows the stereotypical features found in various fields of science. Here the capacity is the capacity of the underlying networks. The probability is the likeliness that each component within the networks be in either one of the two opposite states.

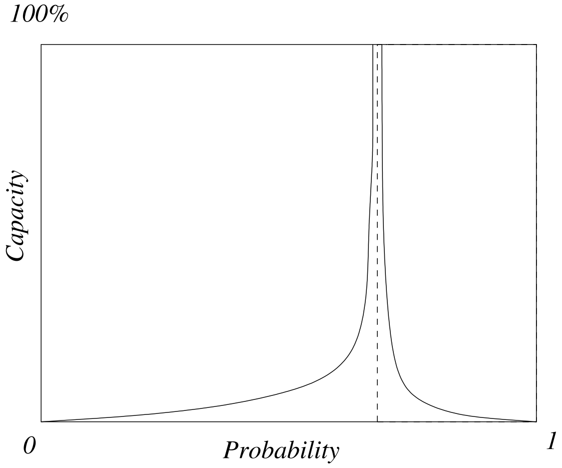

Figure 1 *Transition at the critical point in an infinitely large networks.*

In a very large network the phase change is abrupt, the rate of change close to the critical point approaches infinity as shown in Figure 1. Such situation exists only in theory. In the study of economics only Figure 2 is applicable since the amount of resources are limited thus rendering an infinite growth in either way impossible.

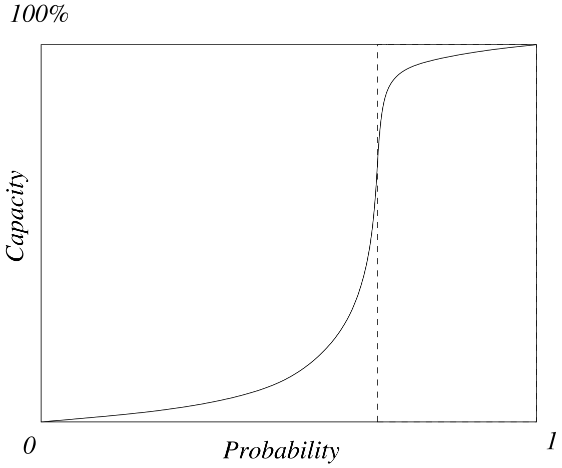

Figure 2 *Transition at the critical point in a networks of limited size.*

Figure 2 shows two distinct features which are the exponentially increasing part and the part where saturation occurs. Both of these features are those normally found in economics.

Proposition 2.1. Quantitive factors in economics can always be explained by using a phase-transition model as the one shown in Figure 2.

Proposition 2.2. Qualitative factors which are the potentials and the driving forces behind economic changes comprise other things as well as education, unemployment, forestry condition, environmental condition, militarianity, epidemics, spending habits of population, extend and level of corruption in government or management, morality, occurrences of crimes, drug problem, productivity and war.

Proposition 2.3. Every abrupt change in economics comes from gathering potential of all the quantitative and qualitative factors involved.

Proposition 2.1, 2.2 and 2.3 mention about two kinds of factors in economics namely, those which are qualitative and those which are quantitative in nature. In order to be able to make a computer model it is necessary to quantitise qualitative factors. Also the structure of the network needs to be identified. These are among those tasks to be carried out in the following stage of this study.

§ Conclusion

Any model which can explain extreme situations in economics is a better model than existing ones. Such a model will enable a better prediction of economical future via simulation as well as allow better understanding in the subject.

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Critical Probability and other Properties of 2-D Tessellation

Kittisak Tiyapan

Preface

The paper in § ℵ has been presented at the MTNS-96 conference at the Ritz-Carlton Hotel in St. Louis.

The Conference Program says that there will be no general proceedings published for the conference, and that all authors whose papers have been presented at the conference are encouraged to submit them for publication in the *Journal of Mathematical Systems Estimation and Control* which is published by Birkhäuser, Boston. Under the authorship of Kittisak Tiyapan, G. A. Davies and David J. Bell the paper has been duly submitted for publication in the said journal but did not pass the refereeing. Apart from the few minor typographical errors corrected, this paper is the exact reproduction of the original one whose manuscript is now lost.

When I first submitted the paper I planned that if it was accepted I would ask both Professor Bell and Professor Davies to be its coauthors, but since I was afterwards informed that there would be no conference proceedings for the conference I never did. Much of the ideas behind it comes from Professor Davies, though most if not all of the work was mine. The presentation session was called *THA10: Analysis of Queueing Networks* on Thursday 27th June 1996 , chaired by L. Dai of the Washington University.

Kittisak Tiyapan, *Critical probability and other properties of 2-d tessellation*, Mathematical Theory of Networks and Systems–96, 24th –28th June 1996 (27th June , Session on Analysis of Queueing Networks). The Ritz-Carlton, St. Louis, Missouri.

2nd September 1996

§ Abstract

The critical probabilities of Voronoi tessellation and some other uniform lattices, including triangular, square, honey-comb, and Kagomé lattices, are identified by mean of an algorithm developed. The properties of these uniform lattices agree with existing well known results. This work provides the bond critical probability for Voronoi tessellation.

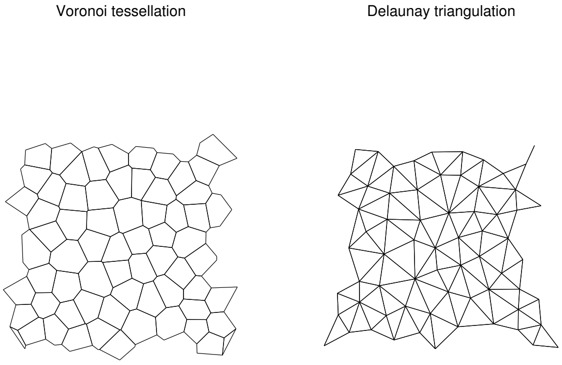
§ Introduction

A tessellation is an aggregate of cells that cover the space without overlapping. A Voronoi polygon is also known as a Dirichlet polygon, a Wigner-Seitz polygon, a Theissen polygon, a Blum's transform, an S polygon, a cell model, a plant polygon, Wirkkungsbereich, etc.

Definition 1. Let Φ be a distribution of a countable set of nuclei $\{x_i\}$ in R^d, and let $x_1, x_2, x_3, \ldots$ be the coordinates of the nuclei. Then, the Voronoi region is

$$\Pi_i = \{x | d(x, x_i) < d(x, x_j) \forall j \neq i\}$$

where $d(x, y)$ is the Euclidean distance between x and y.



Voronoi tessellation

Delaunay triangulation

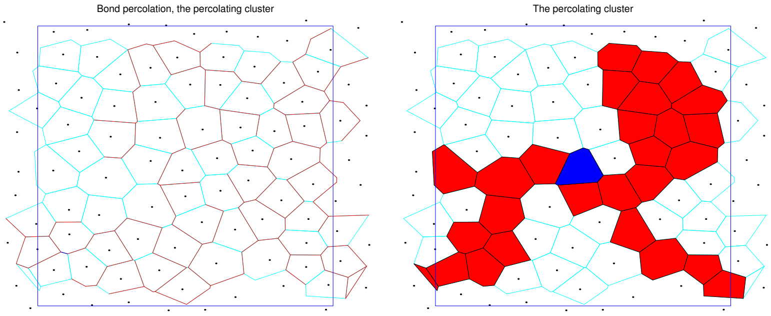
Figure 1.. Duality of Voronoi tessellation and delaunay triangles.

The number of Voronoi points (nuclei) and edges are both O(n) where $n \in N$, and the number of Delaunay triangles and edges are also O(n) (Ahuja and Schachter, 1983).

A bond-problem of any lattice L can be translated into a site-problem on L^c, its covering lattice constructed (Shante and Kirkpatrick, 1971) by the following procedure,

1 . Replacing each β_i by α_i^c.

2 . Creating β_i^c by the rule that $\forall \alpha_i^c, \alpha_j^c \in L^c$, α_i^c and α_j^c are connected by a bond of L^c if and only if their corresponding β_i and $\beta_j \in L$ have a common terminal atom of L.



(a) *Example of a bond percolation* (b) *Example of a site percolation*

Figure 2 *Example of (a) a bond and (b) a site percolation.*

A list of applications can be summarised into two groups according to the two main groups. *Bond percolation* finds application in hydrology (movement of water in dam structure, intrusion of sea water in coastal areas, filter beds, *etc*), petroleum engineering (petroleum and natural gas production, exploration, logging, *etc*), chemical engineering (heterogeneous catalysis, flow through packed beds, gel permeation chromatography, porous polymer films used in separation processes, biological membranes, inorganic membranes, *etc*), medicine and biomedical engineering (biological membranes, biological filters, flow of blood and other body fluids, electro-osmosis, *etc*), electro-chemical engineering (porous electrodes, permeable and semipermeable diaphragms for electrolytic cells, *etc*), and in communication (performance of communication networks with blockage). *Site percolation* finds applications in permeation through filtration membranes (Bell *et al*, 1995), sieve blinding (Wilkinson and Davies, 1989), membrane fouling, (for example, of the Anotec (ANOPORE) microfiltration membrane) and in the form of pore clogging, effect of back-flushing and crossflow microfiltration have been studied and close agreement with experiments was obtained.

At and above the *critical probability* p_c (Shante and Kirkpatrick, 1971) a percolating cluster, a cluster that spans infinite length, occurs. A mathematical definition of p_c can be found in Bousquet-mélou (1996).

The exact value of p_c for some of the uniform lattices can be found by the method of series expansion (Onody and Neves, 1992; De'Bell and Essam, 1983). But for a Voronoi lattice, at this moment, there is no deterministic method. The only possible way is by doing simulations on the lattice as has been done here.

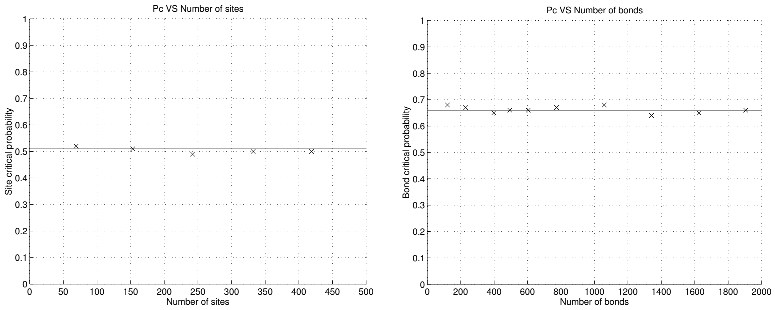
§ Results

Simulations are made by a developed algorithm (Tiyapan, 1995) based on Monte Carlo method. The results are best presented graphically.

Here $p^s_{c,\mathrm{avg}}$ and $p^b_{c,\mathrm{avg}}$ are the critical probability of site, and bond percolation respectively, averaged over a reasonably large amount of simulation; $n(i)$ is the number of clusters which have i members, where $i \in I$; n is the total number of elements, that is sites for a site problem and bonds for a bond problem; $n(i)_{\mathrm{max}}$ is the size of the largest cluster at a specified p; and p is the ratio between the number of blocked elements and the total number of elements. The coordination numbers for a Voronoi lattice is assumed to be the number of neighbours of each element, averaged over every element within the network. To make clearer a pictorial demonstration of the result, in most of the pictures only the first cluster which percolates is shown.

§ Discussion

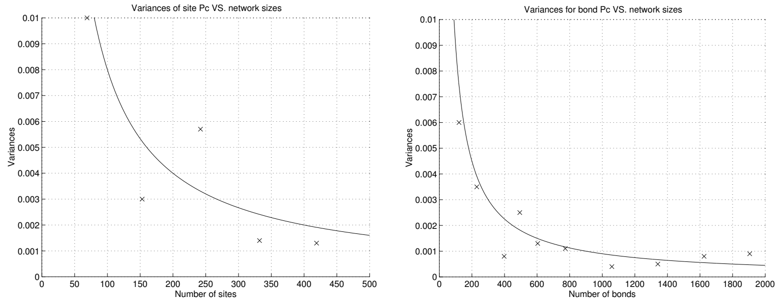
From Figure 3 (a) and (b) it is clear that the critical probability is independent of network size. Thus p_c is a property that is intrinsic for each type of network, and further studies show that it differs from one type of network to another. The idea of infinite cluster is also confirmed.



(a) (b)

Figure 3 *(a)* $p^s_{c,avg}$*'s plotted against number of sites, (b)* $p^b_{c,avg}$*'s plotted against number of bonds*

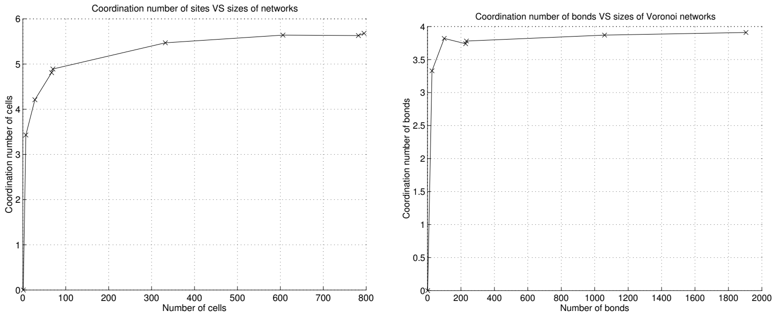
Figure 4 (a) and (b) show that the value of p_c's can be accurately obtained by either doing one simulation on a very large network, or by doing many simulations on a smaller network, since they show that the variance of the results reduces with increasing sizes.



(a) (b)

Figure 4 *(a)* $\sigma^2_{p^s_c}$*'s, and (b)* $\sigma^2_{p^b_c}$*'s, plotted against sizes of networks.*

Coordination numbers (mean contact numbers) of sites and bonds of Voronoi networks are plotted against network sizes in Figure 5 (a) and (b) respectively. The values seem to be approaching, but never reaching, 6 and 4 for site and bond problems respectively.



(a) (b)

Figure 5 *(a) Coordination number of sites, and (b) Coordination number of bonds, plotted against network sizes.*

Some example of p_c's obtained from simulation are, *(a)* square lattice, 220 bonds, $p^b_c = 0.53$, $p^b_{c,\mathrm{avg}} = 0.47$; *(b)* triangular lattice, 305 bonds, $p^b_c = 0.33$, $p^b_{c,\mathrm{avg}} = 0.34$; *(c)* honeycomb lattice, 111 bonds, $p^b_c = 0.65$, $p^b_{c,\mathrm{avg}} = 0.64$; *(d)* Kagomé lattice, 174 bonds, $p^b_c = 0.55$, $p^b_{c,\mathrm{avg}} = 0.52$; *(e) [399 nuclei, 240 cells,* $p_c = 0.47$, *limit* $= 0.04$*]* site problem for Voronoi lattice, $p^s_{c,\mathrm{avg}} = 0.51$; and *(f) [400 nuclei, 324 cells, 1044 bonds, bond percolation, limit* $= 0.04$, $p_c = 0.65$*]* bond problem for Voronoi lattice, $p^b_{c,\mathrm{avg}} = 0.66$.

§ **Conclusion**

Critical probability is a value which is intrinsic to each type of networks. The value for each uniform or random lattices is constant and does not depend on the size of network.

[All the simulation] result shown in this paper was done by MATLAB running on UNIX workstations. The program used for the generation of Voronoi lattices was adapted from Jafferali (1995). A Kagomé lattice can be generated from either a triangular lattice or a honey-comb lattice (Tiyapan, 1995).

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Critical Probability in Traffic Modelling and Control

Kittisak Tiyapan †

2^{nd} April 1998

§ Abstract

Percolation has been playing a big role in many fields of Physics, Chemistry as well as Forestry and Biology. But up to this time its application to traffic modelling and control has not been mentioned in existing literature, contrary to its inherently similarity in nature to the field. This work is an attempt to introduce it to this application.

§ Introduction

Percolation says that for any kind of network of connection among components, namely vertices and bonds, there is one parameter with its own unique value which could be different from other or other kind of networks. This parameter is named the *percolation probability* or the *critical probability*. This critical probability or p_c marks the transition from one of the two phases into another.

§ Theory

In order to be succinct, only one theorem will be briefly mentioned.

Theorem 1. For any traffic networks the state of traffic at any moment can be described as being in one of the three states, namely free-flowing, congested or stand-still. Furthermore, the free- flowing case corresponds to the case where $p < \min(1-p_c)$, the congested case to the case where $\min((1-p_c), p_c) \leq p \leq \max((1-p_c), p_c)$ and the stand-still case to $p \geq \max((1-p_c), p_c)$.

Proof.: From percolation theory we know that there exists $0 < p_c < 1$ for any networks. Obviously p_c can only have a value within one of these three intervals, that is < 0.5, $= 0$, or > 0. Furthermore, we may consider the percolation as being percolation of flowing roads as well as the percolation of jammed roads. Our interval from 0 to 1 can then be divided into three sections, namely $0 < p < \min(1 - p_c)$, $\min((1 - p_c), p_c) \leq p \leq \max((1-p_c), p_c)$ and $\max((1-p_c), p_c) < p < 0$. The first one of these three intervals corresponds with the situation where cars have not yet percolated while space has. And thus it corresponds to the free-flowing traffic. The next one corresponds either to the situation where both cars and space has percolated, or to the situation where neither has percolated, depending on whether $p_c < 0.5$ or $p_c > 0.5$ originally. And thus it corresponds to the congested traffic. And the last one corresponds to the situation where cars have percolated while space has not and therefore to the stand-still traffic. The case where $p_c = 0.5$ is a special case where the second one of the three intervals considered vanishes. □

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† The author wrote this article while he was at Tokyo Institute of Technology.

§ Traffic Modelling

For modelling purpose, the percolation probability of the networks being considered is obtained by using the procedure shown in Figure 1.

The structures of the data mentioned in Figure 1 are given below.

Data structure 1. Junction data in file named Junction. 3 datasets per record. J, the number assigned to this junction, of type I^+; x, x-coordinate of this junction, of type R^+; y, y-coordinate of this junction, of type R^+.

Data structure 2. Road data in file named Road. 3 datasets per record. R, the number assigned to this road, of type I^+. i, the number of the junction at one end of this road, of type I^+. j, the number of the junction at the other end of this road, of type I^+.

Data structure 3. Cluster. C, the number assigned to this cluster, of type I^+; n, the amount of roads belonging to the cluster, of type I^+; f, the fractal dimension of the cluster, R^+; M, set of member roads of this cluster, $M = \{m_i : m_i \in \text{(cluster C)}, m_i \in R, i = 1, \cdots, n\}$.

For illustrative purpose a network of an imaginary city called City X is considered the percolation probability of which was found to be approximately 0.75, averaged over 20 simulations. With the construction of a ring road the percolation probability of the same networks was found to be approximately 0.72, averaged over 20 simulations. That is to say the addition of the ring road reduced the p_c.

The results shows that the ring road added resulted in the reduction of the p_c. And since the p_c of this network is > 0.5, this also resulted in the reduction of the probability that this network will be in a congested situation.

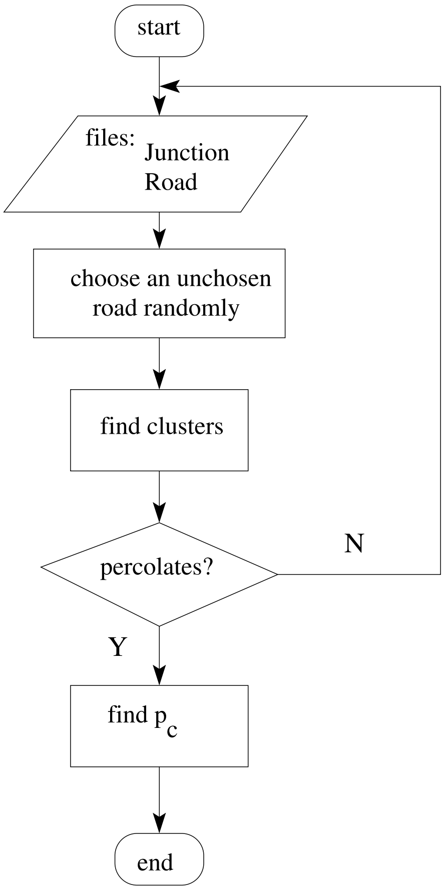

Figure 1 *Procedure for finding the critical parameter of a traffic networks.*

§ **Traffic control**

Let S be the situation where the percolation of roads where traffics are flowing occurs. S is namely *space percolation*. And let H be the situation where the percolation of congested roads occurs. H is namely *car percolation*. The decisional cases in Figure 2 are cases where $(S \wedge \neg H)$, $(S \wedge H)$, $(\neg S \wedge \neg H)$ and $(\neg S \wedge \wedge H)$ for cases number 1, 2 and 3 respectively. The parameter t_k in Figure 2 is the sampling time of the data. t_k could be approximately 5 minutes.:

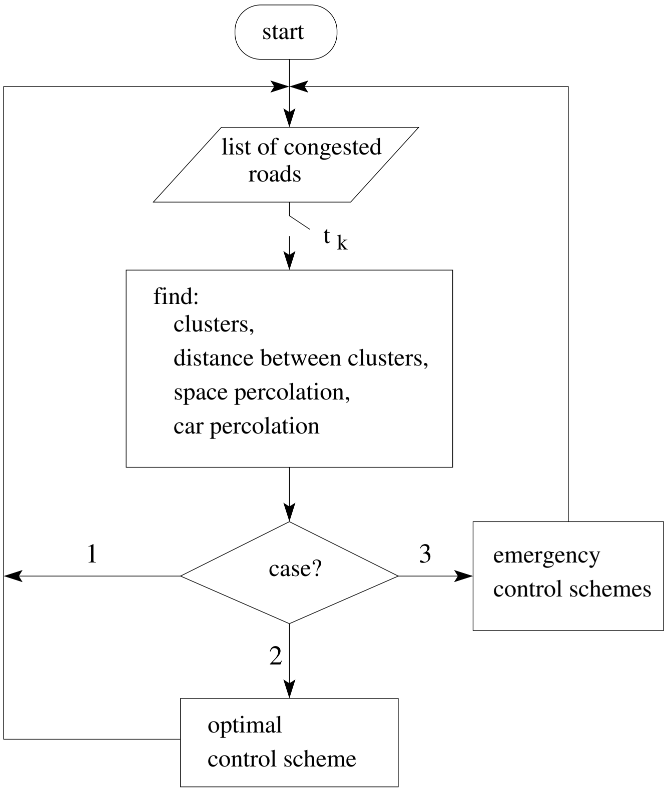

Figure 2 *Traffic control scheme for City X.*

§ Conclusion

I hope that this work has shown the possibility of applying the percolation theory to modelling and control problems of traffic networks.

More work is still needed to be done in order to deliberate upon this idea. It is important to note also that this approach, if turned out to be feasible, could be similarly applied to fields where other kinds of traffic are concerned too, to mention but one of such fields is the traffic inside the Internet.

Language Study at an Open University

Kit Tyabandha

19th June 2004

In the UK the Open University was established in 1969 according to what Harold Wilson said in 1963 to be a university of the air. In Thailand the Ramkamhaeng (in SPT† Daiï, *Rạmgaṃhạeng*) University borrowed the idea and began its career as the country's first open university in 1971. In 1984 it opened a second campus. Unlike its British prototype where courses are all through correspondence, the university holds its lectures in regular classes where you can attend, even though perhaps half of these can be studied at home using the materials and long-distant means provided. The only differences between Ramkamhaeng and other, so-called *closed* universities in Thailand is that it has neither entrance exams nor SOTUS, that militarial discipline based on seniority, order, tradition, unity and spirit, which I guess began under the reign of Rama V.

Particularly commendable at the university is the study of languages at its Faculty of Humanity. Here in 1992 I obtained from the Faculty of Science a Bachelor of Science, and now I am learning towards a Bachelor of Arts in languages at the Faculty of Humanity. I have studied at this university Burmese, Cambodian, French, German, Greek, Hindi, Laos, Malay, Pali, Russian, Sanskrit and Spanish. I never retain much of what I have learnt in class unless I use it. I sometimes write essays and later forget how one could write them. In a Spanish writing class taught by Eduardo Domínguez Suria we once were asked to write what we would do had we three magic matches that allows us whatever we wish. On 17th February 2004 , that was, when I wrote the following.

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† Sanskrit-Pinyin-Tiyapan

> Si habría tres cerillas mágicas, pegaría una en aire libre y miraría el cielo. Creo que verse a través del espacio la cara de Dios. Depués vería en la tierra y puede ver a través del interior del tiempo el origen de humanidad. Verse también quizá la historia de nuestro planeta. Observaría los dinosauros. Queriese observer el Tyranosaurus-Rex corriendo en el llano. Si habría cerillas mágicas mirarse en el sol y verse la formacíon el sistema solar, y mirarse en el Milky Way y verse el nacimiento de nuestra galaxy.

I am probably the worst student in the class. I had only studied one course of the language. For this class I only sat in, and not study for the exam. Eduardo commented what I wrote into the following.

> Si tuviera tres cerillas mágicas, encendería una al aire libre y miraría el cielo. Creo que puedo ver a través del espacio la cara de Dios. Depués miraría la tierra y podría ver a través del interior del tiempo el origen de la humanidad. Vería también quizá la historia de nuestro planeta. Observaría los dinosaurios. Me gustaría observar el Tyranosaurus-Rex corriendo por el llano. Si tuviera cerillas mágicas miraría el sol y vería la formacíon el sistema solar, y la via láctea y podría observar nacimiento de nuestra galaxia.

Would any of you like to add to this his own ideas or wishes?

Plagiarism

Kit Tyabandha, Ph.D.

13th July 2004

People borrow too much from other people. Some say that if you do it nobly then it is all right. But even these, to me, are still borrowings all the same.

It is worse if you do it for some earthly benefits, less so if for Arts. Some do it like a game, keeping counts of those ideas and things they have covertly appropriated, like a womaniser does the counts of virgins they have slept with.

As Shakespeare has put it in his Love's Labour's Lost,

'There is no such sport as sport by sport o'ertrown,
To make theirs ours and ours none but our own:

Problems associated with technical papers and publication in general come not singly, but in mass. Regarding the quality of the writing at least two parties are normally involved, that is the author and the editor. Regarding the former there are mainly questions about competency and honesty. As Perwiz (1997) † puts it, 'A wrong theory is forgivable, but an experimental result that cannot be repeated is not.' As for the latter, Broad and Wade (1982) think that reviewers should not pass on papers sent to himself to others, or if they did, should report the publisher.

The game of acquiring a long list of publications is a rather new development. In 1958 James D Watson became an associate professor at Harvard with only 18 papers on his curriculum vitae. According to Broad and Wade (*ibid.*), 'The preoccupation with publication has resulted in a veritable ocean of journals and papers.' They quote Cole *et al* (1972) as saying that only a few scientists contribute to scientific progress. The majority publish works having little or no impact on the 'forward march of knowledge.'

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† Max Perwiz. Science is not a quiet life. Unravelling the atomic mechanism of Haemoglobin. *World Scientific.* 1997.

Between 1960 and 1980 the number of authors per paper rose from 1.76 to 2.58, according to the Institute of Scientific Information at Philadelphia. Plagiarism in scientific community is evidentially not rare. Neither is it a new invention. Broad and Wade (*ibid.*) mentioned a story of Claudius Ptolene who, researching in Alexandria library, appropriated work of a Greek astronomer and called it his own. Another story which is of our time is that of a Jordanian plagiarist Elias A K Alsabti, a hoax full of lies and legerdemain who had more than sixty plagiarised published papers. 'If plagiary,' asked Broad and Wade, 'the greatest offense against intellectual property, merits just knuckle-rap treatment from the scientific community, what degree of indulgence must be accorded to lesser crimes?'

Nevertheless,

> Each time a new case of scientific fraud breaks into the headlines, the scientific establishment generally responds with one variant on another of the 'bad apple' theory. The faker was a psychopath, or under great stress, or other wise mentally disturbed, this theory goes. Its unspoken implication is that all blame should be put on the erring individual, not on the institutions of science.

If this is this widespread and common there must be something wrong with the latter.

Not only plagiarism but also deceit is a problem in publishing community. The same authors gave examples of Galileo's distortion of his experimental results, Newton's 'fudge factor', Dalton's experimental results nobody has been able to repeat, as well as Gregor Mendel and Robert Millikan. On this they say, 'any result known to be false or dishonest in any respect must be retracted, lest other researchers who may be relying on the result be misled and waste time in following a false path.'

According to them, Max Weber think that devotion of individual scientists to the truth is what keeps science honest. They say according to Murton, the selfl-policing nature of science, that is to say, peer-review, referee system of journals and replication of results, is the reason why society has no needs to interfere in scientific affairs. Peer-review is carried out by advising committee of scientific organisations while refereeing is done by journals. Generally speaking the former gives advice while the latter judge merit and novelty, as well as spot any defects in the argument or technique. Among other things, when receiving a paper from somebody who has never published in the field, the editor, they say, should verify its credential by requesting reviews by individual prominently cited therein.

A controversial experiment was done that stunned those who hear it by Sokal in 1996, as he revealed it later in the same year. He submitted a scientifically rubbish, dressed up to seem honourable paper, to *Social Text* (Sokal, 1996a), a leading journal on Sociology, and later confessed what he had done in another journal *Lingua Franca* (Sokal, 1996b). The following are some of the words made by Sokal. He said he was 'troubled by decline in standards of rigour in certain precincts of academic humanities.' 'But I'm a mere physicist:' he says, 'If I find myself unable to make heads or tails of *jouissance* and *différance*, perhaps that just reflects my own inadequacy.'

He says further,

> What concerns me is the proliferation, not just of nonsense and sloppy thinking per se, but of a particular kind of nonsense and sloppy thinking, one that denies the existence of objective realities, or (when challenged) admits their existence but downplays their practical relevance.

As Mathematics is the language of all science, if Sociology is a science it has to adopt mathematical logic at least in its methodologies. No matter how weird a theory may be, for example Quantum theory, the methods of proof are always the same and purely logical.

When talking about 'subjectivist thinking,' he says,

> Intellectually, the problem with such doctrines is that they are false. There is a real world; its properties are *not* merely social constructions; facts and evidence do matter.

And he argues,

> If all is discourse and 'text', than knowledge of the real world is superfluous; even Physics becomes just another branch of cultural studies. If, moreover, all is rhetoric and language games, then internal logical consistency is superfluous too: a patina of theoretical sophistication serves equally well.

Here he may have been mistaken. Nothing of any importance in this world is mere 'rhetoric and language games.' Even Shakespearean clowns and hic comic jumbles serve some purpose or another in their particular context. Philosophy, Music, and even Arts, all are real. Surrealists, for instance, sometimes capture dreams, but they by no means are the only people who do so. Neurologists and psychologists at least on a regular basis do just the same thing. He must bear in mind that a piece of writing may not, nor has to, though it should mean the same thing to two different persons reading it. So what he has written to mean one thing may to another reveal something totally dissimilar to what he had intended.

It is still unclear in this case who is the more immature and unprofessional, the experimenter or the editor who was experimented upon. As a rule of thumb, defence is more difficult to make than attack. No one can be always on guard adequately enough in reality where the time in one's life is limited. Analogous to the arts of fighting, the best defence is to attack, only that this discredits the party doing it. After all life is only a game, not a fight. One cannot help but think that, if he could convince an able editor, he could convince us anything. Such experiment makes later arguments of the experimenter doubtful. The only excuse he has may be that he published his revelation. Sokal himself wrote, 'Of course, I'm not oblivion to the ethical issues involved in my rather unorthodox experiment.' 'Professional communities,' he says, 'operate largely on trust; deception undercuts that trust.'

Now, to be fair to the editor, it may be that Sokal has his paper in print for its footnotes, so many of which he has put in that it exceeds the actual contents. Thus the former argues confirming his criticised decision, that this is because 'all works cited are real, and all quotations are rigorously accurate; none are invented.' He says, 'Now, it's true that the author doesn't believe his own argument. But why should that matter? The editor's duty as scholars is to judge the validity and interest of ideas, without regard for their provenance.' These words of his ring true, because a piece of writing is like another person, different from its author. It is his offspring, his brain-child which has its own life, sometimes ideas.

These problems of scientific announcements are here. We may have to live with them all our lives. Yet they also teach us something. Every branch of science must be prepared to withstand criticism not only from within its own circle but also from outside of it, from other branches of science. And in the case of plagiarists? Like serial killers, they teach us to probe deeper into our own mind and society. Similar to them, they are nothing unimaginable but the very products of our civilised society.

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Percolation Theory and Economic Modelling

Kit Tyabandha

2^{nd} October 2002

Even if there existed only a single economic catastrophe in the whole history of man one would have needed to come to a conclusion that it is governed by a percolation theory. In fact the number makes no difference, only the existence is of consequence. If only there had been but one that would have been one too many, but there are too many of these catastrophes for us to ignore their presence.

Economic and world histories tell us that the freedom possessed by each part in all scales of the social structure is a sufficient condition for the robustness in the economics and society. I feel that it is also a necessary condition.

These phenomena are like percolation. All existing economic theories are valid up to and not including the point where they occur. Therefore, if we must understand the working of our economic system we have to know it in the light of the percolational theorems.

Lack of freedom has already proved to be disastrous following the collapse of the Soviet Union and the eastern block countries. Deprived from their freedom, people and states alike will soon become poor in their facility to think because it had neither been practised nor honed. Interventionism has shown to be equally disastrous, as though we could measure the depth when they occur and compare, by what happened to Germany following the end of the First World War. The Bismarckian Empire collapsed in 1918 as a consequence of military defeat. The first immediately striking economic consequence of this was the growth of the public sector. Another change was that more of the government expenditure came under control of the central state. Then in summer 1922 hyperinflation set in as a consequence of the percolation which ultimately resulted in the Second World War.

The Roman Empire died because it depended too much on the central government in Rome. All the roads, no matter they led to Rome or away from it, only helped to increase the coordination number of the capital city of the empire. Every city in a robust empire, according to the percolation theory, has to be linked to its local nuclei city. With a single nucleus the network has only one cell, and that is too small for a network to be able to withstand any attack or to be robust. This is so disregarding whether the network is large or small, and in fact the larger it is the worse it will become. In this respect the United States, with its various states and local governments, is the best model that we have. The British Empire, together with all other empires that are its contemporary, has already expired. And the ends of all empires in that fashion seems to say something similar to our idea of a robust structure. All of them had colonial territories, but non of these were treated as equals by the ruling countries. The European Union could fare better if it learned from them, as well as from mistakes that the U.S. had made.

Economics modelling

My interest in the modelling of economic systems started immediately following the devaluation of the Thai Baht in July 1997, which in turn triggered the economic collapse of east Asian countries. But the seed of this interest may have been germinated nearly seven years earlier when I went to Budapest for a job training through a program by the *Association Internationale des Etudiants en Sciences Economiques et Commerciales*, aka AIESEC. It was there that I experienced firsthand an economic system with inherent potential, but which was ailing and struggling to survive. It was also there that I have come to know the word *hard currency* and learnt about terrible consequences to people in a country whose money is otherwise from being hard. Some of these consequences are the proliferation of black markets where money is illegally traded for hard currencies like the US Dollar or Deutsch Mark, and the ever soaring inflation rate. In Poland at that time, for example, the inflation is above 700 percents. In such an unstable society stealing is a matter of fact in everyday life. Robbery becomes so widespread that the police no longer bother to catch robbers, and this is so much a more decent thing to do since otherwise there would have been no place to put them in in the first place. This I know because it was in Poland around June 1990 that I was robbed of nearly all of my personal belongings. Afterwards when I have become initiated to the theory of percolation, I ascribe the transition between a hard and a soft currency to the percolative process. Now I still see this, as well as the changeover of the eastern bloc countries, as a phase transition.

My brief presentation at a conference in Japan (Tiyapan, 1997, ℵ)

has been warmly received by some of the experts who attended, despite criticism from a member of the organising committee before the presentation. My belief was, and still is, quite different from the conventional theory as to the cause of this national mishap. Instead of seeing the attack on Thai Baht made by an American hedge fund which is run by George Soros, I put most of blame on other seemingly unrelated factors that deprive Thailand of essential robustness in many of its fundamental structures, particularly on too much centralisation towards Bangkok and the percolated traffic networks in that city which came close to a standstill. Others argue that the Soros hedge fund represents a corporate crime against a nation because no matter whether it is the true cause of the catastrophe or not the intention of attack was there. But such is not the kind of matter which concerns us here. In essence, I give all the value to the structural soundness of a system and the infrastructures and none to any single occurrence or mistake in management decision. A country, I argued, will run sound if if it has a potential to do so, and not otherwise. The potential of a country depends on such things in the background as all the infrastructures including transportation and telecommunication systems, education, forest, and decentralisation.

The self-sufficiency practice recommended by King Bhumibol of Thailand in his annual speech to the Thai people on his birthday in the December following the crisis is the very core idea of decentralisation in disguise, namely that of local management which will ultimately lead towards local government. In his speech he told the Thai people to live a self-sufficient life, to grow vegetables in the backyard enough for one's own need, and to sell and make a business out of it if one has more. I believe his idea goes deeper and his teaching more a parody from the necessity from him to remain impartial even in the face of a crisis. In short, the self-sufficient of oneself will lead to that of one's family, village, town, district, province, and finally the country. The Constitutional Laws have been changed to favour this, which I think is a crucial step.

There has been a complete turnaround in the policy in Thailand now compared with what had been before the 1997 crisis. Then it was everything to be centralised in Bangkok. Every prosperity, you name it, must go to the capital, and every policy out from it. It had been so for a long time, for many generations, and democracy did not much improved it. When Smyth (1898) lived in Thailand in the 1890's he saw what I had seen one century later in the 1990's, that everything beautiful in Bangkok comes from, and at the expense of, the rest of the country which is left to be poor. Anyone travelling in the city even today can see quite easily that Bangkok by no mean represents Thailand. With this kind of policy, no doubt everyone tries to get to Bangkok. This worsen its problems further. Nothing that I may say on this point can be better than the following account made by Smyth from the work already quoted.

> I am certain that the Government in Bangkok have never realised the disastrous effect which the system had on the distant province. The revenue each year was maintained at the proper figure, and therefore no questions were asked. The money went to Bangkok, and the P. W. D. spent it in improving the look of the town. Visitors were impressed with what was being done in Bangkok, and went away persuaded that Siam was an enlightened country. The poverty-stricken condition of the provinces did not come under their notice. 'That's all our money,' cried a disconsolate provincial Government to me, spreading wide his fingers towards a canal in Bangkok beautifully embanked, with a charming road on either side. 'I have had to roof my court-house at my own expense.'

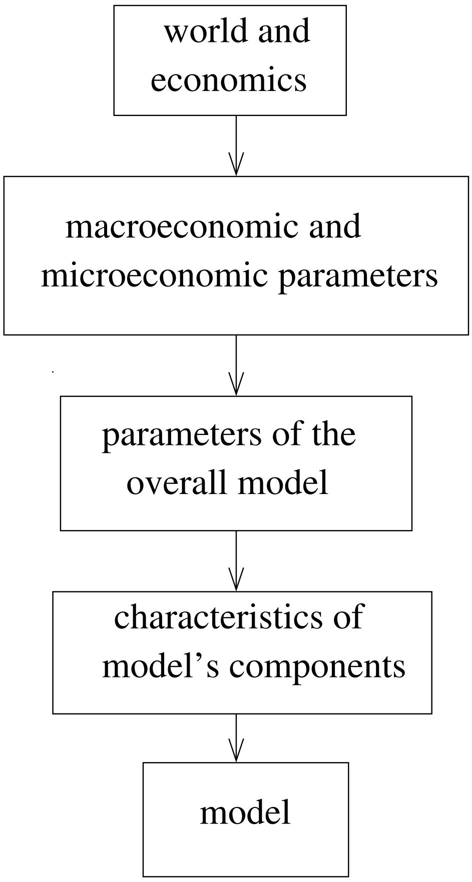
Fifty years on, the canals in question started to deteriorate and fifty years later either have been filled to make more roads or left a dirty sewer. In 1992 there was a plan made by the Bangkok Metropolitan Administration to construct wastewater treatment plants around Bangkok. The construction was to be in two phases each of which worths 5,000 bahts, and equivalent of 120 million pounds sterling. At that time I was working at the Loxley International Public Company in Bangkok in the capacity of a sales engineer. In the second bidding for this turn-key project I was transfered to the Business Development Division to work as the estimator of the project, reporting directly to Mr. Ronald James Savage who was one among the Board of Directors of the company. Loxley joined force with several consultants and contractors to bid for this project, and as the company was to provide all the necessary equipments and technologies my job was to search all corners of the world for everything everyone would need. It was challenging, but then I was a workaholics so it was all I needed. In the end we did not win the project, however, so that is as much as I have to say about it except for one thing, that is that I think the wastewater treatment project came far too late and was still not completed when the 1997 crisis occurred. Seemingly unrelated, in the present argument and together with other things such as traffic, education, decentralisation, it has got everything to do with that crisis.

Now the policy has turned into that which lets the remote parts of the country manage their own funds and make their own decisions. There is, for example, a scheme of *a product a village* that fosters local artisans. As a result, local heritage becomes fad where is only five years ago it was fiction, something to forget, not to think about. If there is no hiccough in this process or a *coup d'état* of some sort, then the policy of Thailand now is by far sounder than it ever had been. Therefore Thailand to me now is in a better shape than it used to be when it was still dubbed a *tiger or the East*. However people often think otherwise. I always find myself involved in a controversial or difficult issue, and on the wrong side thereof. Before the crisis, for instance, when most people looked up to America with hopeful eyes I always said to my colleagues, 'we should not put our whole faith in America', that Thailand should not rely too much on any other countries, and I was looked at questioningly. After 1997 I said, 'it's not half the fault of the Americans or anyone else but us', and I was eyed with disgust. The hedgefund which attacked the Thai Baht in 1997 was only an instrument, not the reason, for what happened thereafter. It answer the *when* question, but the more important *why* question has already been answered long before that (*cf* Smyth, 1898). I can say this because as early as 1990 while the Thai economy was in the bull I wondered myself why it has not collapsed because, as I often said when discussing with my colleagues engineering students, according to my reasoning it should. Immediately after the disastrous event while the country was in the blue and I was in Japan I told myself that I had already known why it happened, now I knew *when* and *how* it did.

What followed was a period of a few years when the whole country, noticeably Bangkok, was so quiet you would not believe. For some times the country was a paradise for travellers. Everything was cheap and nothing was not on sale. Instead of increasing, I felt that on the whole crimes had reduced, perhaps because such tragic events always shook the hearts of people, the thieves' and the gentles' alike. The Tourism Authority of Thailand coined this marvellous word *Amazing Thailand*, to promote tourism in Thailand abroad, which fitted the mood of the country like a glove because everyone felt like staring wide-eyed with disbelief at what had happened and what was happening around them. I was equally amazed at what was happening around me when I visited Thailand from Japan, but not at what had happened because, like the next great Tokyo earthquake, I had been expecting it for quite a while before I got tired and stopped thinking about it.

An analogy of distributed government can be seen in computer science under such terms as distributed systems, parallel processing, and object-oriented programming. I see it as essential, if not as the only way, towards a sound and robust economic systems.

At this ATACS conference in Tokyo in October 1997 I explained economic modelling as follows.


world and economics
macroeconomic and microeconomic parameters
parameters of the overall model
characteristics of model's components
model

The economics of the world can be represented by macroeconomic and microeconomic parameters. Together these two make up the parameters of the overall model and describe the characteristics of components of the model.

Later that year I submitted two papers (Tiyapan, 1997, ℵ and ℵ)

electronically to a journal, the American Journal of Physics I think it was. For the reason that both papers were products of my personal research interest which has nothing to do with my commitment to the Tokyo Institute of Technology, I could only spend a meagre amount of time on them. As a result, the work was too preliminary and there was no reply from the publisher except the first computer-generated message saying that they have received my files. No matter how poor my papers were, I felt that to get a negative feedback from an editor was already bad enough, but to get no reply was worse.

In the light of the argument above, what Hammond (1998) called a *Market World* corresponds to the case where the globalisation expands smoothly and permeates all countries from developed to third world to form a single unbroken cluster. What he called a *Fortress World* corresponds to the world where the the free market only benefits some countries while the rest is left deprived. The poorer countries encroach on the richer ones like water encroaching the residual oil in an oil reservoir; islands of prosperity surrounded by seas of poverty. Yet his third and last vision or version of the world, the *Transformed World*, would correspond to a changed structured of the network of culture and economy which gives a more robust system and accommodates all the needs of the future generations. Among the things that are changed in this case are the cultural norms and values.

Cultures are like languages. Like switching from one language to another, when travelling to another country one switches from one frame of mind into another. Unless this is properly done there will always be some adverse symptoms to experience, and *culture shocks*, which are common in novices, become less so in experts. In the languages of cultures, when we deal with the Japanese's we should keep as much a polite manner as possible and take our responsiblilities to the other party as seriously as possible regardless to what the small prints might or might not say. On the other hand if we are to conduct our business with the Americans, for instance, we should question every move. Generally speaking while the West favours contracts, the East has been run mainly by personal relations. The catch came when the latter party adopted so many of the ways and ideas of the former, and these got improperly mixed together with its own ways of thinking which are different to produce an incoherent, unstable and insecure structure. Stevenson (1895) when travelling *out of himself* to the United States in 1879 came across a Mexican who was scruple enough to knowingly sign an imperfect paper for fear that the other party might think that he doubt his words otherwise. The scruple sounds odd, he said, because we "have been brought up to understand all business as a competition in fraud, and honesty itself to be a virtue which regards the carrying out, but not the creation, of agreements." This no doubt answers the question why the 1994 economic crisis in Mexico occurred.

Because there is more to the economic well being of a country than economic figures can tell, one needs to look around in order to to find clues to what is going wrong. For this, the richest source is in the literary literatures, some of which had seeped out through the unconscious minds of some of the most experienced and sensitive minds. Also, at least in the field of economics the study of science and the social study should go along side-by-side. More than economic figures and those things which meet the eyes, studies in this area should take into account hidden factors, for example education, centralisation and policy in general, and turn them into a form which can be numerically or theoretically studied. Centralisation always adversely effects the economics, for instance the greater control by the central state of government expenditure as well as growth of the public sector Germany immediately after the First World War is followed by the hyperinflation which began in summer 1922 (*cf* James, 1986).

Descriptions of economic crises usually resemble percolation, even though or especially when they come from someone who has no ideas of percolation in his mind. For example, Rodelet and Sachs (2000) think that small events at times have large consequences. They talk about crisis of success, that both the collapse of Mexico in 1995 and of Korea in 1997 came after a prolonged period of euphoria. In Thailand, for instance, indicators in the third quarter of 1997 suggested nothing like a financial meltdown. On the other hand, while Mlesi-Ferretti and Razin (2000) mention a 'perfectly forseen speculative attack' as the thing which triggered the crisis in this case, there is no question about the network having already greatly weakened before the attack.

One has to distinguish things which trigger from things which cause. One can be very much certain that crises of this scale must come from a very slow process which works on the structure within. It may be true that delaying bubbles from bursting this way even results in a deeper crisis afterwards.

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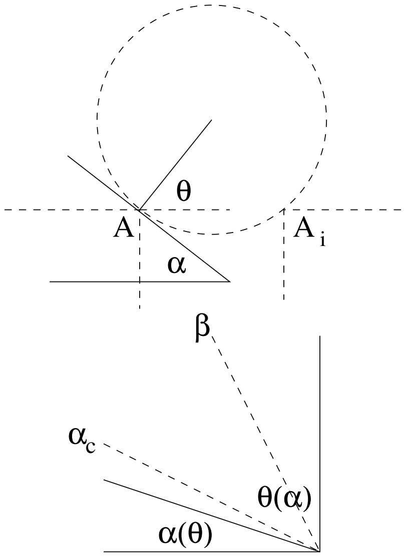
Quantum Mechanics within Percolation within Percolation

Kit Tyabandha

Introduction

This is not an article about another film on star wars, nor is it Aztec's glimpse of technologies of some lost Atlantis. But it is related to the good old filters used in chemical processes. According to chemical engineers filter fouling is a mechanical process where particles' shape is spherical and preferably their size uniform. The blocking of the challenging particles in the pores follows the rule of thumb proposed by Rose and England in 1973 in where a particle for which $\theta < \tan^{-1}\gamma$ will blind the sieve. Here θ is the angle the line of reaction force exerted against the particle by the material makes with the horizontal plane, and γ is the angle of friction. This formula can be explained by looking at Figure 1



Here a spherical object sits on top of an aperture in a sieve and $\alpha + \theta = \pi/2$. Without loss of generality, assume $\gamma < \pi/4$. Let $\mu = \tan\alpha_c$

be the coefficient of friction at some critical value α_c. Furthermore assume that α_c is small, so that we can approximate μ by the angle of friction γ. Then we have $\alpha_c = \tan^{-1}\mu = \tan^{-1}\gamma$. It follows that the particle will block the pore whenever $\alpha < \alpha_c$, whereas it will pass through the latter when $\alpha = \pi/4$. From experiments we know that some particles do lodge against the pores and blind them, there must exist some $\alpha_c < \beta < \pi/4$ such that this happens. Empirically the number of particles that blind is small, therefore we know that β is small. Let $\beta = \alpha_c$. We may now say that the particles will blind if and only if $90° - \alpha_c = 90° - \beta < \alpha < 90°$. For other remaining values of α, *viz.* both $\alpha_c \leq \alpha \leq 90°$ and $\alpha < \alpha_c$, in other words $0 \leq \alpha \leq 90° - \alpha_c$, then, particles must block. But $\theta = 90° - \alpha$, therefore the particles pass through when $\theta = 0$, blind when $0 < \theta < \alpha_c$ and block when $\alpha_c \leq \theta \leq 90°$. So the blinding particles have $\theta < \alpha_c = \tan^{-1}\gamma$.

The empirical value they gave for γ is approximately 20°, which gives $\theta < 0.3358$. For a spherical particle, this gives $x/r = \cos\theta > 0.9441$, therefore the diameter of the particle must be at least 1.0592 times greater than the aperture in order to blind it. This important observation by Rose and English finds application in numerous Chemical Engineering simulations of membrane fouling, one example if which is the algorithm used by Jackson (1994) which is described here as Algorithm 1.

Algorithm 1 *Interaction between particles and surface pores*

```
while another particle exists do
  $i \leftarrow i + 1$;
  $p_i \leftarrow$ particle ;
  find particle entry coordinates;
  $c_i \leftarrow$ of the nearest Voronoi cell;
  $f_i \leftarrow$ the nearest face of $c_i$;
  if the face is fouled then
    for all the neighbouring faces $f_j$
      if $f_j$ is not fouled then
        $\{f\} \leftarrow f_j$;
      endif
    endfor
  else
    $\{f\} \leftarrow f_i$;
  endif
  if $\{f\}$ is not empty then
    $j \leftarrow 0$
    while particle travels and $j < |\{f\}|$ do
      $j \leftarrow j + 1$;
```

```
          if $d_p > d_i$ then
            if the centre of $p_i$ lies outside the largest
                circumscribed circle of $f_i$ then
              $f_i \leftarrow$ the neigbouring face $f_i$ of the adjacent cell;
            endif
            if $d_p > 1.1d_i$
              particle cakes or blocks surface;
            else
              particle blinds surface face;
            endif
          else
            particle enters membrane;
          endif
        endwhile
      else
        particle cakes or blocks surface;
      endif
    endwhile                                                        □
```

Jackson *et al* (1999) studies porous media and represent them using Voronoi models. They assume fouling particles to be spherical. If the diameter of a particle is less than that of a pore then the particle will entrain the pore unless it should encounter other fouling particles, but if the particle is bigger than the pore then it will be retained. Their studies by and large follow the algorithms developed by Jackson (1994) for the cake formation, fouling and the flux decline caused by these two.

All these studies mentioned assume the particle and pore sizes commensurate to one another. However Schumacher (1996) observed how particles much smaller than the pores form clusters and block them. He reported internal fouling of the 0.2 μm and 0.45 μm CA membranes. These particle deposits lead to channelling and an additional resistance which causes further flux decline. They were thought to have arisen from the interparticle and interfacial forces. This effect was accounted in none of the previous studies mentioned.

Theory

Tiyapan (2003) formulates this into a problem of a continuum percolation within a network percolation. Here an effect of Van der Waals force is involved.

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The Writings of Oliver Sacks

Kit Tyabandha, Ph.D.

8th August 2004

I came across *Awakenings* by Oliver Sacks in 2002. Since then I have been fascinated by his works. I have learnt so much from him, and the inspiration received through the reading is wonderful.

This essay is written as an introduction to Sacks's writings. It uses much of the notes taken through the course of reading his books. We try not to quote too much, but at the same time want as much as possible to keep the flavour and style of the originals. All the books were borrowed from the John Rylands University Library at the University of Manchester. Perhaps I should say the Victoria University of Manchester because the title above is now reserved for the new university that is going to come into force starting from September 2004, when VUM joins UMIST.

Awakenings is about post-encephalitic patients and the terrible drug L-DOPA that had been for some time popularly used for treating it. James Parkinson wrote *Essay on the Shaking Palsy* in 1817 where he recognises clusters of seemingly unrelated symptoms, like constellations of stars, that have in fact a common cause and should be treated as such. Parkinsonism is a constellation of syndrome. More than being merely a diagnostic syndrome, this curious assemblage has its own coherent order and logic.

Charcot between 1860 and 1890 observed affinities between Parkinson's disease's symptoms and those of catatonia, depression and hysteria. He considered Parkinsonism a neurosis. The disease itself is uniquely profound. There are matters like, for instance, eretism and kinesia paradoxa. It contains three phases, namely compliant-perseverative, explosive-precipitate, and obstructive-resistive. Sacks is a British neurologist. Many of the patients in mentioned in his books were those under his treatment while he was with Mount Carmel in Bexley-on-Hudson, New York. The place was opened after the first world war, carrying the name then as 'Mount Carmel Home for the Crippled and Dying.'

Encephalitis Lethargica is commonly known as the sleeping-sickness. With its great variety of symptoms, it has been referred to as, for example, atypical poliomyelitis, atypical rabies, epidemic disseminated sclerosis, epidemic Parkinsonism, epidemic schizophrenia, and epidemic delirium. Instances of this have occurred in 1580 in Europe, in a form of a serious febrile and lethargic illness, Schlafkrankheit, during 1672–3 and 1673–5 in London, and during the winter of 1916–7 in Vienna. If we relate this to the works by Hoyle and Wickramasinghe (1979) we may be able to see how these could be associated with visits by some cosmic bodies, carriers of original organic materials needed for evolution.

Constantin von Economo reported the brains of people affected by the disease contain virus which could transmit the disease to monkeys. † In 1957 he finds severe damage to the substantia nigra, that is a nucleus in the midbrain containing large pigmented cells, in patients with encephalitis lethargica who had previously shown severe symptoms of Parkinsonism. Usual symptoms are deep coma, or sleeplessness and somnolent, or insomniac attack. The patients, if they survived, often become zombies. Symptoms may include the following, akinesia and akathisia, explosive and obstructive disorders, push and resistance, hurry and impediment; automatic compliance or obedience; catatonia and tics; destructive outbursts, rages and tantrums; echopraxia, echolalia, palilalia, and so on, that is to say, the echoing of words and phrases; erethisms, erotomanias and libidinal excitement. The higher faculties, that is imagination, intelligence and judgement are spared. They are each fated to become the unique witness to their own catastrophe.

Post-encephalitic syndromes appeared between 1927 and 1967, the symptoms which appear after years of recovery from the sleeping sickness. This gives rise to the neurological and psychiatric disorders now known as Parkinsonism. Sacks describes the sense of what is lost and must be found, which he says is a metaphysical one. The patients may search with painful urgency here and there, and then mistake, in Donne's words, the 'Apothecary's shop' for the 'Metaphorical Deity.'

Laevo-dihydroxyphenylalanine, aka L-DOPA, is an awakening drug. Some species of bean contain large amounts of L-DOPA. DL-DOPA is a mixture between the biologically active L-DOPA and its inactive isomer D-DOPA. Heavy transquilizers like amantadine, apomorphine, bromocriptine and L-DOPA alter the dopamine systems of the brain, particularly the mid brain and striatum. Using these drugs we run a high risk of 'blitzing' the brain, which may be unable to tolerate such bombardment of changes forced on it. As Sacks puts it, 'One must not rush in where angels fear to tread.' The medicine works like a magic, and then it fails. It produces an awakening which is followed by tribulation and then accommodation. Often there is a reciprocity between health and sickness. As time goes by, patients become more and more sensitive to dosage, the range of equilibrium amount to be administered become narrower and narrower, and the reactions become ever more complex. And when this happens, it does so utterly that the patient ends up far worse than before he undertook the treatment. In any case the doctor often says that he has given him the magic, but it failed, and therefore he washes his hands of the case. The drug produces a vicious cycle, Galen's circulus vitiosus. It is like a fire being lit to illuminate the brain that turns into a conflagration and consumes it completely; or a fire that warmed a house and then burnt it down. It becomes increasingly impossible to match dose level and brain-phase, because whereas the former only has one dimension or parameter, the latter has many dimensions.

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† Viruses are sometimes referred to, in technical terms, as sub-microscopic, filter-passing agents.

One patient recalls that under the influence of L-DOPA she was gripped by what were by no means alien to her real self. Neither were they purely physical either. The drug seems to release something deep within her, something she was never conscious of , pre-historic and prehuman landscapes, or a kind of confession or disclosure of her unknown self. Things inhuman, animal-like behaviours, bizarre notions and motions, excitations, involuntary movements, mannerisms, tics, for instance, have been observed and associated with the effect of the drug. Not less so other behaviours of primitive and prehuman sorts. Evidently the drug gives rise to memory of long-past scenes as well as presentiments of what still could be. The immediacy of vivid recollections is the remarkable characteristic.

Confounding is the contradictory characters of akinesia and hyperkinesia, which could come either alternately or simultaneously as a paradox. A patient may find himself unable to start doing something, and when he has finally managed to do it he finds it equally impossible to stop doing it. What is defeat in us, that is this disease that eludes treatments, may prove far more valuable to us than we imagine. Sacks compares this with our inability to solve an algebraic x which led us to the reality of a transcendental value.

Every crisis is unmistakably a crisis, but no two crises are exactly the same. This is similar to the wide variety of tinnitus we have. An attack, for example, can sometimes be surrealistic, a delirious product of the forebrain. At other times only music can get him going. One patient describes how she was unmusicked and needed to be remusicked. Another says the music must be legato, for staccato music produces an effect somewhat bizarre. When a patient seems lost in reverie a light touch sometimes causes the awakening.

According to Kant, music is a quickening art. Rhythms alone are not sufficient; they must be embedded in melody. Degenerate music forces, while healthy music frees. The one sickens whereas the other heals. One patient can not move unless you give her music. And literally speaking only by music which moves her was she moved. The pace of life in these people seems to be running amok, that regular blinking, or loud-ticking watch may help pace and prevent incontinent hastenings and retardations. Another says her freezing was not what it seemed. She said she ran out of the space to move in, but she was still going. Her space, their space, is nothing like our space. Their space gets smaller and bigger, it runs into itself and bounces back on itself. At times the space they experience seem non-Euclidean. On the other hand no loss of ideas of dimension can be seen, only illusions of scale. At other times the reaction is normal, but what is abnormal is the perception. The space-time judgements become phantasmal and illusionary. This may be similar to the effects of some drugs like marijuana, which leads one to suspect that these affect the brain and rob us of ourselves. Others, for example dynamic-, or kinematic-mosaic vision, are also seen in intoxications induced by belladonna, LSD, in psychoses and during migraine attacks.

Sir Thomas Browne once said, ‘Thus when God forsakes us, Satan also leaves us.’ One of Sacks’s patients said he thought of killing himself. But in the end, after years spent in his illness and near dying, he admitted it had been a good game, encephalitis and all; he was glad he had decided to live. One’s hidden selves are let loose. Peculiar thoughts appear by themselves in an absolute torrent of thoughts. Another patient often came to a stand-still. But Sacks argues she was perpetually moving in an ontological orbit that had been contracted to zero. Anyhow, for her no time had elapsed. Leibniz said, ‘Quod non agit non existit,’ what acts not exists not; activity is actuality.

On the other hand activities may become greatly accelerated, often seen as a response time of under one thirtieth- compared with the normality of around an eight of a second. It could have seemed to some that some of his patients were merely showing off. But there must have been something there in the first place. A female patient changed so suddenly like a transformation of phase, physiologically reversing by abrupts 30 to 200 times a day. She also had a repertoire of over 300 different tics, and inventing a new one every few days. But, 'Her affects are never neuroticized,' he wrote. She herself was above them, and her tics were never mannerized. With continuing use of L-DOPA this woman show a greater tendency to split into behavioural fragments. The drug, it seems to me, breaks the unconscious mind into clusters and then brings them forwards. The stand-stills of this person both before and after she began taking L-DOPA are the same. While it lasted everything appeared to her flat, sharp-edged and geometric like mosaics or stained-glass windows. Sometimes the vision flickers like a film running too slow. And she said that she saw the future, something that happened several frames too soon. Sacks thinks this may lead to our better understanding of the nature of moments and our time perception, that is if we accept her words for it. 'And if we do not listen to our patients,' he wrote, 'we will never learn anything.' Patients, especially these ones, are a living candle by whose light new things are revealed to us.

Life is music, the inner living flow. The experience just described are impersonal and inorganic as well as it is unreal and unalive. Sacks thinks that it goes with the fragmentation of time and space itself, and against this music. Another patient said he was only wiping his nose, when asked about his frozen poses. A cinephoto-size reduction to sixteen frames per second showed that was actually what he was doing, though at ten thousand times slower than normal.

When a patient freezes, a lightest stimulation from the outside, for example in the form of touch or noise, may make them move again normally. Sacks propounds on his idea of macroquantal states seen under the influence of L-DOPA and microrelativistic states characteristic to Parkinsonism. They are, he argues, complementary to each other. The two terms may require some explanation, since it seems he coined the words. Parkinsonians experience warpings of space and field, the fact which suggests a miniature model of the cosmos, hence 'microrelativistic.' His patient, on the other hand, came out of freeze-frame suddenly with the smallest possible stimulus, say a quantum of energy or a single photon of light. This suggests the total lack of inertia analogous to the stationary states and quantal jumps in electronic orbits of atom. He next predicts a new neurophysiology of quantum-relativistic type. I think his is the Hoyle's of Medicine.

One patient said that her mind was like a still pool reflecting itself, that is to say, that time itself had stopped and her existence was a repetition of itself. However grotesque, everybody, the deformities and diseases are part of the world. Another patient said that this stupid body of his was like prison with windows but no doors, feeling caged and deprived like Rilke's *Panther*.

Sein Blick ist vom Vorübergehn der Stäbe
So müd geworden, dass er nichts mehr hält.
Ihm ist, als ob es tausend Stäbe gäbe
Und hinter tausend Stäben keine Welt.

Often relatives to the patients build instead of helping him lines around their illnesses and reinforce the illness and dependence. Cases are abstract but patients are people, who need diagnosis and treatment but also understanding and care. Leibniz said that the effects of nature can be accounted for in a twofold way, that is by a consideration of efficient causes and again by a consideration of final causes. He argues that these are important both in construction as well as in Physics and Medicine. 'And writers,' he said, 'who take these diverse routes should not speak ill of each other,' but to join the two ways of thinking. Sacks thinks that the reason why medical literature nowadays are unreadable, inhuman and unreal is that we try to reduce metaphysical matters to mechanical ones, that is to say, impressions to analyses, realities to abstraction, and world to systems. He criticises the putting up of the *de rigueur* styleless, objective style where facts, graphs and statistics help produce assembly-line medicine and neurology where everything human are quantised and 'processed out of existence.' According to Leibniz, he said, world's mechanics only serve its metaphysical design. As Pasteur said on his death-bed, 'The pathogen is nothing; the terrain is everything.' Our diseases are ours as much as our health is. Goethe said, 'Everything factual is, in a sense, theory.' 'There is no sense looking for something behind phenomena,' he said, because 'they are theory.' Sacks thinks we should stick to our senses, but try to find a language that can adequately describe it. He certainly is an expert in this, in describing things as a writer.

One should never see all patients as replicas, but pay attention to each one individually. There is a difference between the acting of actors and the passive reaction of puppets. The former is living while the latter degrading. According to Sacks classical neurology can be divided into two schools, that is the holists and the topists, which neurologists call respectively lumpers and splitters. The former see the brain as undifferentiated and uniform, with a total energy, while the latter consider it as a mosaic containing many centres, each with a different kind of energy.

Health and diseases are different from each other in their modes. Whereas the former is expansive and infinite the latter is finite and reductive. Post-encephalitic patients feel withdrawn from the world and immersed in their illness, whereas upon awakening they come to feel the absence of the illness and the presence of the world. The former case similar to what Wycliffe Bible puts it, 'Thanne schal be greet tribulacionn,' and the latter as D H Lawrence does about 'a man in his wholeness wholly attending.' Sacks thinks that the use of the term 'side-effect' is absurd and objectionable. A patient of his also thinks that his head-movements are no more side-effect than his head is.

The disease when removed may leave a space behind such that the patients miss it. Freud thinks that unless substitution can be found in reality for an illness and its advantage, one may forget about influencing the latter through therapy. When tribulation comes like storm, by accommodation you weather it. By homeostasis a potential is built underground like water gathering head, or coiled spring, that produces a percolation that results in a recovery. This potential comprises accommodations of all types, for example cellular, chemical and hormonal levels, and self, that is the will to get well. One may achieve this when he has learnt how to feel at home in the world and realise that action must come together with relaxation. Kinship is healing, and when healing takes place the world is the hospital. Love is the most important thing in the world. What Sacks tells us has also been stressed by both Jesus and Muhammad, by the former as the Love of God of us and the love of us of one another, and by the latter as the love of us of God.

Not only the patients are no longer what they once were, but we all of us also change. Obviously we become older, and usually calmer and wiser. And according to T S Eliot,

And the end of all our explorating
Will be to arrive where we started
And know the place for the first time.

This arriving at the original place is, I am sure, the reunion with the Creator.

Post-encephalitic patients normally understand their illness through the experience of long exposure to it. This makes they a wily fighter of it. The medicine they take in a way gives a philosophical education. Nietzsche (*Fröhliche Wissenschaft*, 1886) sees philosophy as grounded in our understanding of the body. Those who could come out of a neurological disease become child-like and innocent. But it is the innocence of the subtlest kind, because the experience was such an abyss of tortures hardly imaginable.

Leibniz said that music is nothing but unconscious arithmetic. Art is the ear of science. It is not guaranteed to work, but it sometimes does. E M Forster thinks that for art to work some creative impulse has to be first released. Curing the neurologically disabled requires not algorithms as Purdon Martin thought but art. Much has been said about 'contactual reflexes,' but Sacks thinks that contactual is musical and vice versa.

Scientific medicine tries to find the 'It' while existential medicine find the 'I.' What becomes Parkinsonised is the person's subcortical command, what Pavlov refers to as the blind force of the subcortex. This is the 'It' not the 'I.' The patients lack grace because their 'I' becomes subjugated to their 'It.' According to Winkelman grace is the peculiar relation of actor to action.

In his youth Sacks said he was torn between the pursuit of science and the pursuit of art. Now, like Luria does, he wants to see a 'romantic science,' a Kantian science of the will instead of a purely empirical Humean science. He sometimes calls akinesia 'akantia.' His writing implies that we should read Kant's *Critiques*. Also Darwin talks in his autobiography how he regrets having lost the tastes for pictures and music.

Another book by Sacks is *The man who mistook his wife for a hat* (1985.) In 1861 Broca linked aphasia to a particular part of the left hemisphere and mapped the human brain. Freud in his *Aphasia* says that this kind of mapping is too simple. The entire history of neurology and neuropsychology deals predominantly, if not entirely of the investigation of the left hemisphere. While the left hemisphere is thought to be more evolved and sophisticated, the right hemisphere is often seen as primitive and contains the power of recognising reality, and classical neurology was more concerned with schematics than with reality.

Memory is what makes our lives. We usually only lose short term memory while the long term memory is still intact. But if we lose the self ourselves we may never know it, for as far as we are concerned we did not exist. Visual amnesia, for example, is more than blindness. It is the losing of the very idea of seeing itself, and in this case there is no sense of loss. In order to feel a loss one must be able to remember in the first place. Aphasia is caused by disorders of the left-, while tonal agnosias by disorders of the right temporal lobe. Prosopagnosia is the inability to recognise faces and their expressions.

Some of the references are *The Mind of a Mnemonist* by Luria, *The Basal Ganglia and Posture* (1967) by Purdon Martin. There are also those books by Thomas Mann, for example *The Magic Mountain*, *Dr Faustus* and *The Black Swan*. Then there are H G Well's *The Door in the Wall*, R A Henson's *Music and the Brain* (1977), Steven Smith's *The Great Mental Calculators* (1983), E Nagel's *Gödel's Proof* (1958), Luria's *Human Brain and Psychological Processes*, BBC film *Prisoner of Consciousness* (November 1988) by Jonathan Miller, and BBC program *The Foolish Wise Ones* (February 1987.)

The hyper's become para's, that is to say, the excesses becomes the beyonds, for example hyperkinesia becomes parakinesia, and hypergnosia paragnosia. The cause of Tourette's Syndrome is an excess of nervous energy. This causes tics, jerks, mannerisms, *etc*. These behaviours are body-language with grammar and structure. As contrast to the case of Parkinsonians where dopamine-precursor L-dopa is normally given, Touretters are given dopamine antagonist, for example haloperidol, aka 'haldol', to lower their dopamine level. But no drugs can ever be the answer. We do not know enough about either one of these diseases. There are other much subtler and widespread changes than the level of dopamine. But we do know that the disturbance causing Parkinsonism is in the mid brain while that causing Tourette's syndrome is in the old brain, that is the thalamus, hypothalamus, limbic system and amygdala. Here is the home of instinct and the roots of personality.

Babinski, Freud and Tourette together with their teacher Charcot studied neurology and psychiatry together as inseparable. The twentieth century saw a split of this field into neurology which disregards the soul, and psychology which does the body. Neurological and psychological tests now being done on patients it seems, not only intend to uncover their faults and deficiencies, but to decompose them into functions and faults. We pay too much attention to what is wrong with our patients, and too little to what is still preserved and intact. We are all defectology but not enough narratology.

Again Sacks makes some very definitive quotes of various sources, for example his favourite one, 'A man in his wholeness wholly attending,' and, 'Bach lived for him and he lived in Bach.' Especially this last one he seems to have discovered what I had found earlier, that is that the Me is in Christ is in God. In other words, Christ lives for us and we live in Christ. Jedediah Baxton sounds very modern when he said around 1754, 'the musician who turns numbers into music, and the counter who turns music into numbers.' In our case the patients is the musician, the neurologists the counter, music the patients' self and numbers the functions by which we categorise them. Provided one is particular enough, the particular is also a road, nature's road, to reality and truth. I think the particular is a road towards God. In autism is a complete isolation, while in schizophrenia all the influences are from outside, not within. Autistic artists render objects as perceived, not as conceived. These are singularities. 'Can the main,' Sacks asks, 'accommodate, make room for, the singular?' He thinks there is a similarity here to our reactions to genius. All diseases introduce doubleness into life. Each of them is an 'it' with its own demands and limitations.

'To talk of diseases,' says William Osler, 'is a sort of Arabian Nights entertainment.' 'The physician is concerned, unlike the naturalist,' says Ivy McKenzie, 'with a single organism, the human subject, striving to preserve its identity in adverse circumstances.' Perhaps the best quotes of all is these words of Sacks himself, 'animals get diseases, but only man falls radically into sickness.'

There are great composers of classical music whose health related problems helped gave us invaluable musics. For example Shostakovich had a metallic splinter lodged in his brain which when he tilted pressed on his musical temporal lobe and produced melodies which he then used for his music. Dostolevski experienced ecstatic epileptic auras when for a few seconds everything frightfully clear.

There are people with unusual mental power, for example perfect pitch and documentary memory. There are some who mentally see primes of 20 figures quite easily, and some who can see calendar from 40,000 years earlier up to 40,000 years from now, to within day, but yet can not do simple calculation. For them, they *see* the primes, not calculate them.

Talking about the left- and the right hemisphere, a test called Wada test is an injection of sodium amytal into the left corotid artery in order to find weather the left hemisphere is dominant. The brain of a baby during the first six months of its life has an enormous ability to differentiate phonemes. It is important to have the richest environment possible during the early stages of life when the brain plasticity and growth is still there. Linguistic and Sign space is based in the left hemisphere while topographic space is in the right hemisphere. Aphasia affects lexicon, grammar of Sign as well as other languages. But the abilities of other visual space that are nonlinguistic, for example gestures, are in the right hemisphere. Facial expressions are processed by a hearing person in the right hemisphere, but by a deaf person in the left hemisphere. So for the deaf facial expressions are also linguistic.

The self or personality are in the frontal lobes, which contain behaviour, emotion, imagination and judgement. The orbito-frontal syndrome is also called a joking syndrome or witzelsucht. It is environmentally dependent, and its nature is in wisecracking, puns and wordplays. People who have their frontal lobes damaged can have disinhibition and become animal-like, childlike and subject to impulses. Leucotomy used to be done on criminals in the past to change them. Walter Freeman's horrible and hideous transorbital lobotomy led him to win his Nobel Prize in 1951; 'This chronicle of shame,' as Macdohald Critchley said. This is equivalent to a death sentence. Those people through the cure they receive are psychically murdered and dead. Robert Lowell said in his *Memories of West Street and Lepks* the following.

> Flabby bald, lobotomized
> he drifted in a sheepish calm,
> where no agonizing reappraisal
> jarred his concentration on the electric chair
> hanging like an oasis in his air
> of lost connections ...

Frontal lobes give us our inhibitions, in other words consciousness, conscience and conscientiousness. We all need from time to time 'a little holidays from our frontal lobes,' turning from sanity and sobriety towards a Dionysiac rites of sense and impulse. 'The tragedy,' said Sacks, 'is when there is no return from the holiday.' We need more debates on the difference, both ethically and neurologically, between psychosurgery and transquillizers.

Freud says the characteristics of dreams are condensation, displacement and overdetermination. By studying the electrical signals inside the brain we know that the fundamental mechanism is the same for both dreaming and waking. There is a ceaseless conversation going on between cerebral cortex and thalamus. Images and feelings couple one another either with or without sensory input.

In another one of his books, *An anthropologist on Mars*, Sacks starts off by saying what J B S Haldane said, 'The Universe is not only queerer than we imagine, but queerer than we can imagine.' He said what science normally calls a dry impartial light is in fact a dead and dehumanised light. We study things from the outside, never from the inside. I agree with him in this point. We see a percolation and say that it is abrupt. But we never look the percolation going on within, gathering momentum all the time, and that is linear. When such a scientist talks about a type, he never means himself, but always his neighbour. When I said God is Superset, I was immediately accused of being a pantheist. But you could say that that is just about the opposite. In Pantheist everything is God, and nature is God. But I think God is everywhere and everything but nowhere and nothing is God. Nature is created.

He was once asked to 'At least drop the house calls,' to which he said, 'No, I'll keep the house calls – I'll drop everything else instead.' If someone were to suggest that I give up my writings I would say that I will keep my writing but stop everything else instead. Attributed to William Osler he said, 'Ask not what disease the person has, but rather what person the disease had.' He then tells us about the difference between agnosia and anomia, and also about alexia and anosognosic. Agnosia loses past associations with a thing, anomia loses its name. Alexia can not read. And anosognosic have no knowledge of their loss.

In 1884 Hermann Wilbrand separated visual centres in the primary visual cortex for light-, colour- and form impressions. The processing of colours starts in the primary visual cortex from V1- to V2- and then to V4 colour-coding cell. From there it goes higher to hippocampus, which is a storage of memory, and then to limbic system and amygdala, the emotional centre. The cerebral cortex is plastic. Constante use of some parts of the body results in the representation of those parts in the brain becoming larger, for example a finger a blind person uses for reading Braille. Damage to the visual cortex may result in localised unawareness of blindness, while unawareness related to the frontal lobe is more global.

Sacks suggests for reading Howard Gardner's *Frames of Mind*, Antonio Damasio's *Descartes' Error*.

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Money Flow in Networks

Kit Tyabandha, Ph.D.

4^{th} November 1997

§ **Abstract**

The study of economics comprises of two main branches namely, macroeconomics and microeconomics. The model used for simulation in this work take into account parameters from both branches at the same time. Therefore it is a good representation of the real systems. The model is centred around people instead of centred around money as most of the conventional mathematical models do. This would reduce unwanted effects which are related to the latter approach for example, *money illusion*. Such proposed model can be used for simulation. The results of the simulations may then be used for an analysis purpose or for decision-making.

§ **Introduction**

Existing economics models are good for situations where changes are gradual, but there are abrupt changes in economic situations. The *percolation* theory is here used to represent an economic system. Game-theory is useful in modelling economics when the number of players is small. In game theory players interact among one another. In a normal situation in society two people could live far apart from each other and never interact in anyway. In fact this is usually the case. By representing a society by a network having people as the nodes game-theory can still be useful in describing any area covering nodes which are neighbours to one another. But though the results from extensive analysis on small scales using game-theory can play a part in the analysis of the overall network, game-theory is not a necessary part in the study of networks.

§ **Theory**

Most of the existing economic models are good for situations close to economic equilibrium or situations where any changes are gradual. But changes in economic situations are sometimes abrupt. These fast phenomena are important and can not be neglected. They reflect the results of accumulated potential from various sources affecting the economics. An example of such fast phenomena is hyper-inflation. In Hungary in July 1946, for example, inflation rose as high as 4×10^{16}.

The *percolation* theory is useful in representing many things in nature. It finds applications in Physics (Sen, 1997; Bershadskii, 1997), Chemistry (Bychkov *et al*, 1996; Tremblay *et al*, 1996; Shih and Reiser, 1997), Cosmology (Zeldovich, 1983; Kazakov, 1989; Seiden and Schulman, 1990), Biology (Wu and Bradley, 1991; Gerardi and Romiti, 1991; Calzolari *et al*, 1991), *etc*. Characteristic to the theory is an abrupt jump at the onset of percolation which is caused by gathering potentials in the background. The location of the point of percolation depends on the structure of the network considered. Figure 1 shows the stereotypical characteristic mentioned. The saturation part in Figure 1 (b) is there because of the limitation of resources or to be more precise, the limited size of the network. In a network of indefinite size the jump goes to infinity.

Examples of these two phases are the two states of currency, namely hard currency and non-hard currency.

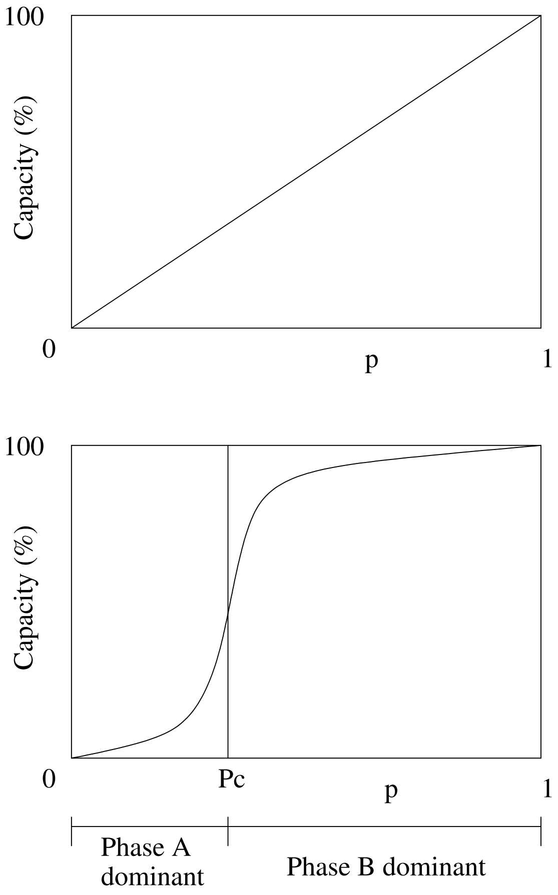

Figure 1 *Potential gathers linearly in* (a)*, but the sign only shows as a characteristic jump (b) at the point dividing dominances of the two phases.*

Definition 1. Consider Nt^n, a network of n dimension. Let Ct_i^m, $i = 1, 2, \ldots, q$ be the i^{th} cluster of m-dimension among a total of q clusters each having a specific characteristic of interest. Then the critical probability of the overall network is expressed as

$$\Big\{p_c : \quad \exists j \in N \quad \text{s.t. } \mathrm{Ct}_j^m \bigcap \mathrm{Sf}^{n-1}_{\inf x} \neq \emptyset \quad \wedge \mathrm{Ct}_j^m \bigcap \mathrm{Sf}^{n-1}_{\sup x} \neq \emptyset \Big\} \qquad (1)$$

According to Definition 1 at critical point of a 2-dimensional network there is a single cluster which spans the network from the left-extreme to the right-extreme line or, from the top-extreme to the bottom-extreme line. Similarly in 3-dimensional networks the cluster spans the whole length of either one of the three coordinate axes.

Definition 2. A society is a network of n dimensions represented by $\mathrm{Sc}^n(\mathrm{Pl}, \mathrm{Mf})$ where, people (Pl) are nodes and paths in which money flows (Mf) are bonds of the network. The n dimensions are n ways in which people are positioned for example, social status, amount of income or educational level.

This means that a society is represented by a network which is comparable to a network of pipes. A junction between pipes is a person. The fluid flowing through the pipes is essentially money though, it may include other media of transactions which have lower liquidity as well.

According to Definition 2 a society is a network with time-variant structure. When a person changes his job, for example, he is moved into another position. Also people born and die, therefore the amount of nodes as well as their positions are changed.

Due to the time-invariant nature mentioned above it is useful to use sampling-and-hold technique when studying the economics networks.

Definition 3. The network for each time-step k is

$$\left\{\mathrm{Sc}_k : \quad \mathrm{Sc}_k = \mathrm{Sc}\left(\mathrm{Pl}(k-1), \mathrm{Mf}\left(k-1, \bigcap_{k-1<t<k} j(t)\right)\right), \quad k = 1, 2, \ldots\right\} \tag{2}$$

Definition 4. The *coordination number* of each node is

$$\left\{\mathrm{Co}(i) : \; \mathrm{Co}(i) = n, \; \forall \mathrm{Pl}(i), \; \exists \mathrm{Mf}(i,j), \; \forall j = 1, \ldots, n, \; \nexists \mathrm{Mf}(i,j) \; \text{ s.t. } \; j > n\right\} \tag{3}$$

The coordination number according to Definition 4 can have a very high value.

Proposition 1. The economical well-being of a society depends on many factors (potentials) which comprises among other things, education, investment, employment, environmental soundness. These factors in turn are reflected in the merit quality of individuals for example, moral, morale, efficiency, attitude and lifestyle. And the coordination number is also related to all the merit factors mentioned. Therefore the economical well-being of a society is reflected in the value of the coordination number.

Proposition 2. One can control these potentials but, one can not control the actual jump. In order to control the jump one could do the following.

- Control the potentials before the jump occurs.
- Build the potentials in the opposite direction.
- Enlarge the network.

Enlarging the network can be done by increasing the resources involved.

Proposition 3. There is an optimal value for the coordination number for all economical networks.

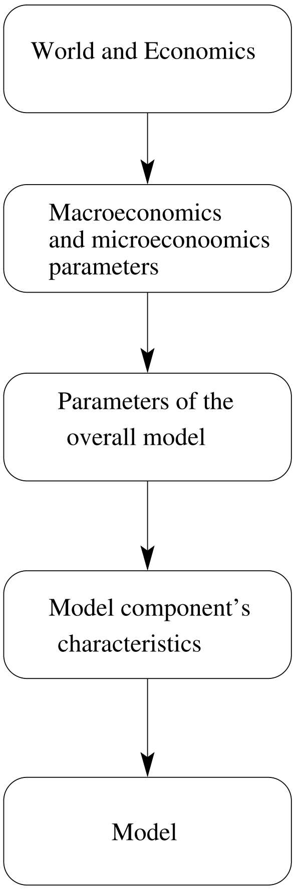
World and Economics
Macroeconomics and microeconoomics parameters
Parameters of the overall model
Model component's characteristics
Model

Figure 2 *Relationship between the world and the model.*

§ Methodology

In Figure 2 certain assumptions must be made when transferring parameters of the real world into those of the model. Here the model is rather a computer model than a mathematical one.

People in the real world are mapped into components within the networks in the distributed random fashion. Groups of people are then represented by groups of components, namely clusters. Examples are companies which could merge to form a larger company much the same way as clusters do to form a larger cluster. Neither component represents any specific person in the real world, nor cluster any specific company. Yet the model as a whole represents the real world, as is reflected in the same statistical values which both of them shares.:

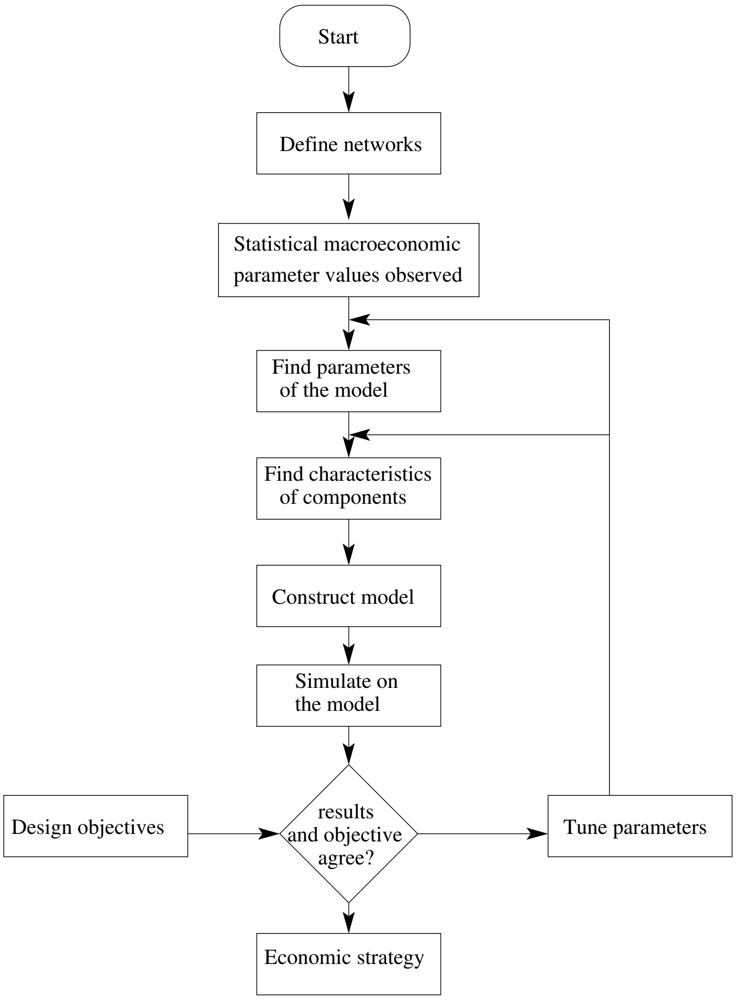
Start
Define networks
Statistical macroeconomic parameter values observed
Find parameters of the model
Find characteristics of components
Construct model
Simulate on the model
Design objectives
results and objective agree?
Tune parameters
Economic strategy

Figure 3 *Steps for economics decision making via simulations on a model.*

Figure 3 shows both the procedure for carrying out a simulation.

§ Conclusion

Definition of money does change. But when people nowadays starve they do so the same way people two thousand years ago did. Therefore a model of the world which is centred around people is better than those centring around money. Further work is to do simulations based on the idea presented and some recorded history and then compare the results with what actually occurred.:

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Book Introduction

Bhạṣạ Angkṛiṣ an Nạ̀soncaị

Kittiśakd́xi Tịyȧbandḣ

2000

ISBN 974–346–182–5

This book is written in Thai with the title which means 'Interesting English' in English. It was written during the time of economic gloom for both myself and my country Thailand. It is built around three major experiences which I consider to be the turning points of my life, namely my studying the Sixth Form English in New Zealand (1983), my acquaintance with a British scholar Amnad Khitapanna since 1985, and my experience in Budapest and Europe (1991). In 104 pages I try to pass on as much as many things as possible those things which I consider valuable from all the three sources mentioned. With my teaching a class in English Literature at the Prad́iṣṭḥ Center in Bangkok as a catalyst the book was published at the Chulalongkorn University Press (2000) under the trademark *Kittix* which has now become my own. From my study of the Sixth Form Engish comes the sections on false friends, alliteration and assonance, onomatopoeia, jargons, Macbeth, several poetic quotations, and the section on books and movies, from discussions with Amnad the seemingly prefixed words for example *dishevelled* and *unkempt*, and songs by Andrew Lloyd Webber, and from my experience of working in Eastern Europe during 1991 the game *twenty questions*. The rest of the materials are mainly what I used in teaching the English class mentioned. They are tragedies *vs* comedies, Titus Andronicus, Julius Caesar, Romeo and Juliet, poems by Don Marquis, and homophones. Apart from that this book also mentions some word games the examples of which are riddles, aeiou-ordered words (for example, *abstemious*), spoonerisms, tongue-twisters, anagrams, scrabbles, crosswords, Targets, doublets, syzygies, word squares, and acrostics. There is a figure which shows the relative degrees of adjectives on a straight line, and also a Venn diagram showing the comparative domains of the English words *wok* and *pan*, and the Thai word *kada*. I had no laser printers and camera-ready copy of the book was printed from a laser printer at the Control System Engineering group at the Electrical Engineering Department, Chulalongkorn University with the courtesy of my former supervisor Assistant Professor Watcharapong Khovidhungij

[Vajȧrȧbongṣ́ Ḳhọviḍụrkic] whom I deeply thank. But the quality of the printing is not very good, which results in some parts of the book being difficult to read. To answer the question I have been asked, the picture in the biography section was from the plastic badge which I used to wear when working at Jasmine in Bangkok.

Kit Tyabandha, Ph.D.
Manchester, England

Book Introduction

Plạe Kled́ Angkṛiṣ

Kittiśakd́xi Tịyábanḋh

2000

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The title of the book can be rendered in English as 'Free Translation of English', the word *plạe kled́* being an adaptation from the jargon of the old Thai sword fighting *fạn kled́* which means *an improvising practice*, or to do this when the word is a verb. Again the camera-ready copy being printed at the Control System Engineering Department except this time with the courtesy of Dr. Manop Wongsaisuwan who is my senior both at the Electrical Engineering Department, Chulalongkorn University, as well as at the Furuta Laboratory, Tokyo Institute of Technology, whom I consider a wizard in the computational matters, and to whom I thank. This is a book about translation written from my experience in translating and inspired by my teaching in a translating class at the same Prad́iṣḍh Center already mentioned. It is a book of translation both from Thai into English as well as from English into Thai. As such, none of the various examples given is easy and straight forward, and all of them have baffled some translators in the past. It was written at the height of my artistic and literarical ability and at the time when I also enrolled in and attended classes in European (English included) literatures at the Ramkamhaeng University in Bangkok. The book starts off with the phrase *kạrplạe gụe kạrplạe gụe kạrplạe,* literally *translation is translation is translation* but which I deliberately translated as *to write is to write is to write* all languages and writings being but translations of the thought. Historically the romans seldom translated but used Greek in their writings instead, and the Greeks never did for theirs were the originals. The book talks about creativity in translation and plagiarism. In general rules may be broken at the right time. Styles of writing are mentioned again without repetition of my previous book. Namely these are the registers and modes of use, alliteration, assonance, onomatopoeias, metaphor, simile, repetition, coupling, rhetoric, allusions, direct and indirect speeches, mythological materials, burlesques, comparative usages of punctuation marks of both languages. The books says that simplicity is the mother of invention. Archaism and parallelism are mentioned, and so are jargons from various disciplines.

Examples from literature includes those by Shakespeare, Lewis Carroll, Yeats, and Sundaurbhụ. In particular the inventive usages of Cockney English is problematic in translation, no negative pronouns exists in Thai so one needs to try hard to find their equivalences. Some of the jargons I mentioned are those of Thai arts, fruits, spices, illnesses, anatomy, fauna, and flora. Some of the humorous clippings from the internet obtained from my friend and computer professional Ken Labinjo in Bristol are also shared with the readers in Thai, some of which needed some explanation to become funny. As for the rest, most of the things I wish to say the book has hardly left out; I would never have thought that I had put so many of them in these 106 pages had I not looked at it again just now. By the way, does anyone happen to know that *novemdecillion* in American is 10^{60} but in English is 10^{114} I wonder. Both my first book and my second one have one problem alike, that is that the computer that I use is of Japanese make and can fluently write Japanese but not Thai. One problem which persisted and baffled me throughout is the mysterious disappearance of all the *ỵ*'s. Ironically enough the alphabet *ỵ* is in Thai called *ỵạu phụỵing*, literally *w for women*! The page on biography is a little more comprehensive than that of the first book. Having mentioned a picture in the previous one, the picture in this book was taken in front of my house in Bangkok.

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